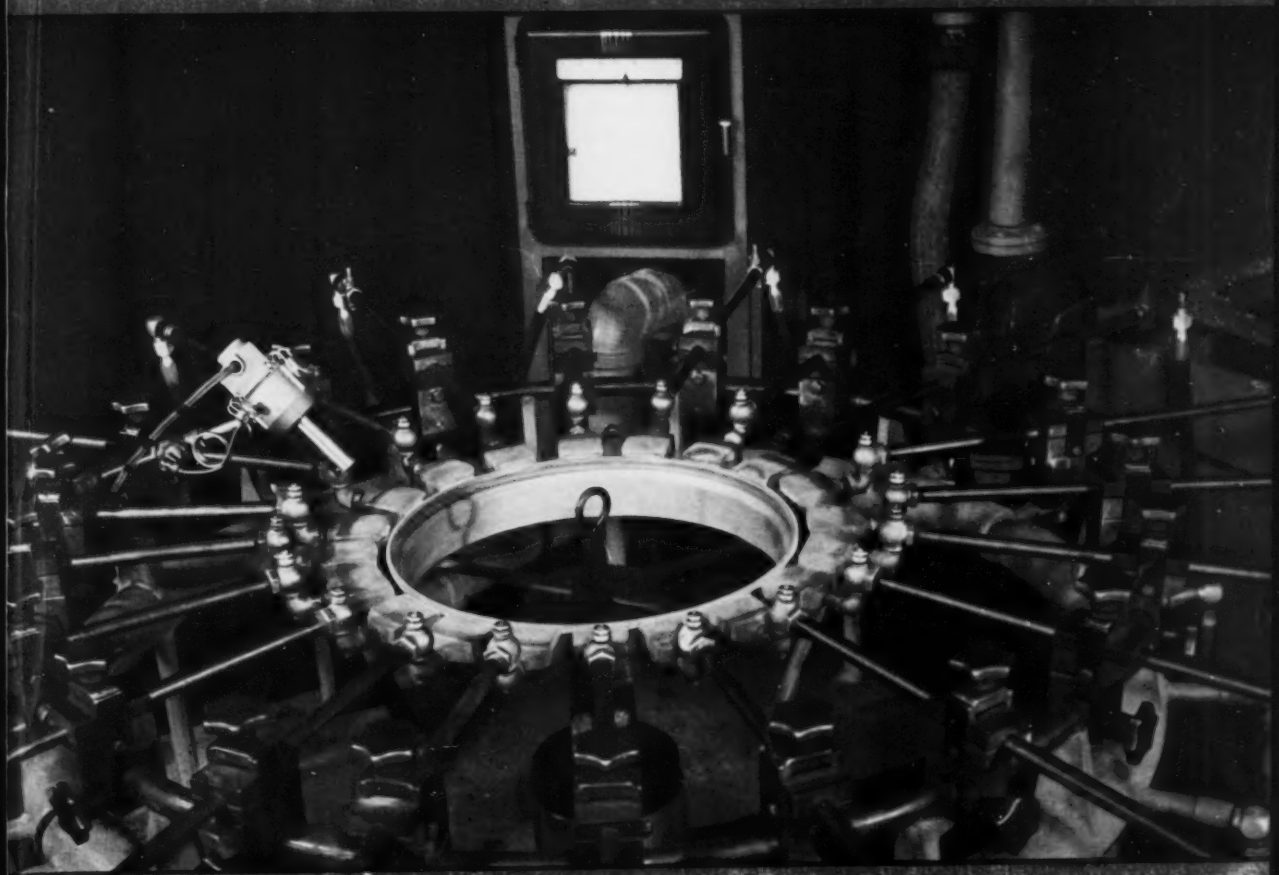
January-February 1954

METAL TREATING

MTI
MASTER CRAFTSMEN
METAL TREATING INSTITUTE

New flame hardening unit featuring accurate temperature control designed and built by the Wisconsin Machine Company—described in detail in this issue.



THE *Only* MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

MORE UNIVERSALLY USED THAN ANY OTHER

Aluminum Heat Treating Method

. . . solution heat treatment or annealing

No other method can match these efficiencies!

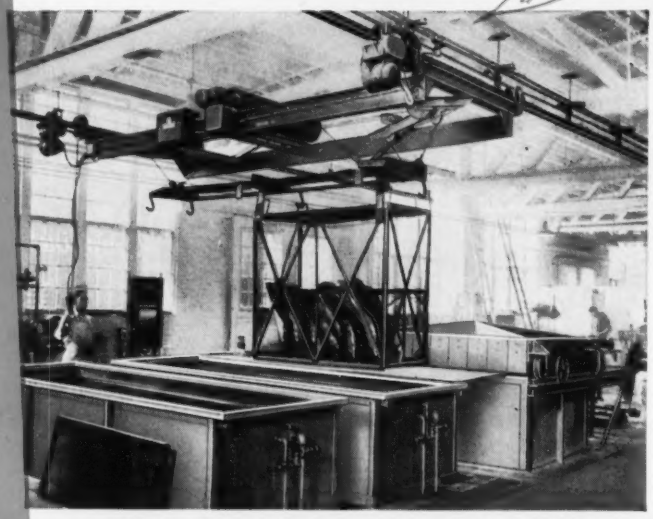
SPEEDIER PRODUCTION—Work comes up to required temperature almost the instant it is immersed in the bath. *More batches can be handled in far less time!*

MORE ACCURATE, MORE UNIFORM HEATING—Temperature does not vary more than 5°F. in any part of the bath. All parts of the work are heated quickly and *evenly*. Careful stacking is not a problem. Because of fast, uniform heating, it is possible to charge simultaneously a wide variation of gage sizes requiring different heating cycles.

SIMPLIFIED QUENCHING—MINIMUM WARPAGE—Work from an Ajax Salt Bath can be removed and quenched in a matter of seconds, thus retaining the properties of the aluminum unimpaired. Pieces can be handled individually or in batches suspended in fixtures. Distortion of parts is reduced to a minimum and much expensive hand forming and straightening can be eliminated. An entire load need not be quenched at once, thus making it easy to keep a flow of parts to the next operation without storage refrigerators.

REAL PRODUCT PROTECTION—Because molten salt is the fastest heating medium known, grain growth is eliminated. The salt film eliminates oxidation and retards air chill on transfer to the quench. In handling clad metal, the fast, uniform heating avoids diffusion, so that corrosion resistant properties are unimpaired.

FAST, CLEAN—BUILT TO LAST—The fast production obtainable from an Ajax furnace cuts costs materially. The furnaces are clean. They're easy to operate without skilled labor. Ten or twelve years of *continuous* operation without pot, electrode or other failure has been the universal experience of Ajax users.



Solution heat treatment of large stampings. Tramrail hoist equipped with cage fixture transfers work from salt bath (at right) to water quench and finally to water rinse tank.

During World War II, Ajax Electric Salt Bath Furnaces were used by virtually every leading aircraft component and equipment manufacturer for heat treating aluminum parts.

More salt baths were used for aluminum solution heat treating than any other furnace type—and this same strong preference is equally evident in today's defense production program.

As proved in hundreds of installations, the Ajax Electric Salt Bath offers outstanding advantages in this field—from heat treating rivets, gussets or short extrusions to large formed parts such as ribs, stretched skins or almost any other aircraft aluminum component.

If it's aluminum, the record proves it can be heat treated better, faster, more accurately and more efficiently the Ajax Salt Bath way!

AJAX ELECTRIC COMPANY, INC.

WORLD'S LARGEST MANUFACTURER OF ELECTRIC HEAT TREATING FURNACES EXCLUSIVELY

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MASTER CRAFTSMEN
METAL TREATING INSTITUTE

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National Trade Association of Commercial Heat Treaters

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METAL TREATING

EDITORIAL

A "NEW LOOK"

As does the industry which we represent and for whom we speak, Heat Treating, we are constantly striving for growth and progress. With this, our first issue in 1954, we pass another milestone, for as you can see we have taken on a "new look";—standard trim size—more color—styled department and feature article headings.

Of course, our basic objectives of presenting to industry helpful information on heat treating and related functions remains the same, but we also keep in mind appearance and readability.

A recently added feature has been our "What's Your Problem" column (see page 24) whose sole reason for existence is to help our readers solve their heat treating problems.

In order to amplify this service a "What's Your Problem" Committee has been established by the Metal Treating Institute to review problems submitted, answer questions on technical phases of operations or equipment, drawing upon their skills and wealth of experience developed through many years of service in the Commercial Heat Treating field.

So, send in your problems any time, we will try to help.

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New Surface Hardening Unit Provides ***ACCURATE TEMPERATURE CONTROL***

Selectively Hardens All Types of Gears, Segments, Cylinders up to 36″ Diameter

By **JOSEPH H. BOCKRATH**
Manager of Heat Treating Department
Wiedemann Machine Company, Phila., Pa.

As the result of over five years commercial experience in flame surface hardening of spur, miter, bevel, spiral and herringbone gears; gear segments; clutch teeth; periphery of winches, crane wheels and many types of cams and cylinders, Wiedemann Machine Company embarked on a project to develop a unit with complete, dependable and accurate temperature control. Working in conjunction with the Selas Corporation, a control system has been developed to provide a flexible, efficient gas-air mixture supply to specially designed burner heads. With the aid of Leeds and Northrup, that company's highly responsive "Rayotube" temperature sensing element of a type developed especially for surface hardening applications and its "Speedomax" recording mechanism were "engineered" to this special setup. Fig. 1 shows the unit in operation with the Rayotube focused on the work piece.

Extremely flexible in operation, this hardening unit can be quickly adjusted to handle any size piece from a few inches up to 36″ in diameter, and of any face width from ¼″ to 12″ or more.

Fig. 2 illustrates the staggering of burners to accommodate a wide face.

Briefly, the unit consists of two semi-circular gas manifolds mounted on movable carriages with 20 or more burner heads which can be set quickly in any desired position. City gas of 720 Btu content per cubic foot is used. Air mixed in proper proportions with the gas is supplied directly from the Selas mixer. The work piece is mounted in the center on a rotating plate while the Leeds and Northrup Rayotube sensing element in combination with the Speedomax recorder alerts the operator as soon as the heated surface of the work piece has reached a pre-determined temperature. The work piece is lifted from the unit by a hoist as soon as the desired temperature is reached, and quenched quickly in either agitated brine, oil or water as required. The quench tanks are located directly below the unit. The rotating platform shown in Fig. 3 is moved to one side so that the load may be lowered straight down to minimize transfer time.

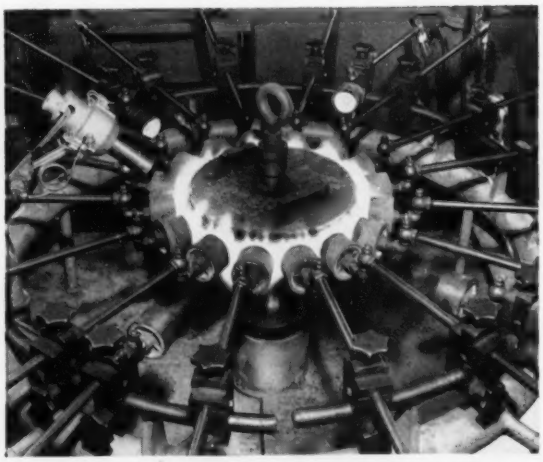

Fig. 1—New unit in operation with Rayotube detector focused on work. Burners are adjustable for work up to 36″ diameter.

Surface Hardening Fills a Specific Need

When a gear tooth deflects elastically in service, the greatest deformation must occur in the surface —not in the center. Therefore, the toughness of

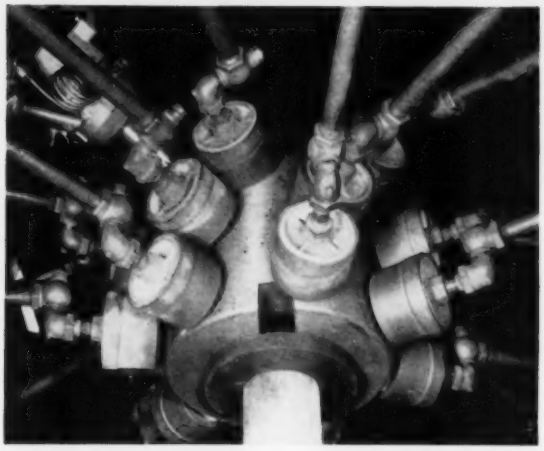

Fig. 2—By staggering burners, the entire surface of a special roller with 12" face is uniformly hardened by the unit.

the surface, more than that of the core, governs the toughness or brittleness of the tooth. Deeper penetration and a milder quench are secured by some alloy steels. This gives more uniformity of hardness with a minimum of distortion.

Every gear presents a problem of its own, and details of this hardening process can be varied to produce satisfactory properties for the individual gear concerned.

Many parts require final machine work after heat treating, such as finishing a bore, threading or keyWaying a bore; hubs have to be threaded or drilled at location or in the field; journals, shafts or rolls where only face or journals must be hardened and the remainder finish machined afterward, etc.

The hardening method described here permits selective heating, under well controlled conditions, resulting in full surface hardness and controlled depth of penetration, within close limits. The original core properties of the work piece are left undisturbed, permitting the desired physical properties to be determined by previous heat treatment. Surface hardening does not stop abruptly in depth, but as shown in Fig. 4, is bonded to the core metal by a transition zone ranging from that of the hard case down to the softer core. A piece can also be hardened almost fully to the core.

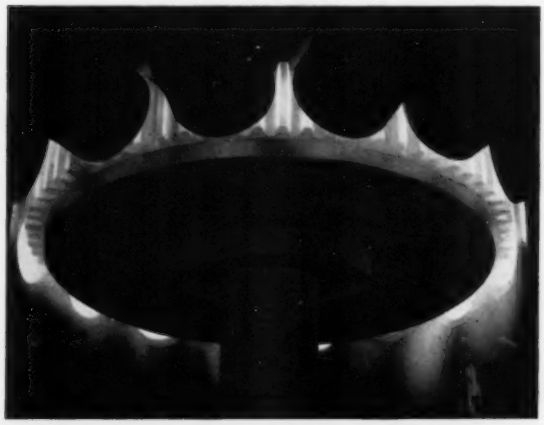

Fig. 3—Underside view of an 18" diameter ring gear being heated by cup burners. Selective hardening the gear teeth only prevents distortion of the welded areas of the gear.

Two types of burners are used for high-speed heating of different classes of work. The "Superheat" type burner, used for localized heating, effects heat transfer by the convection effect of high velocity combustion gases issuing from an outlet slot in the burner. For hardening larger areas, the radiant cup burner provides a rapid heat transfer rate to the work by radiation from the highly incandescent ceramic cup surface and by convected heat of the hot gases without flame impingement.

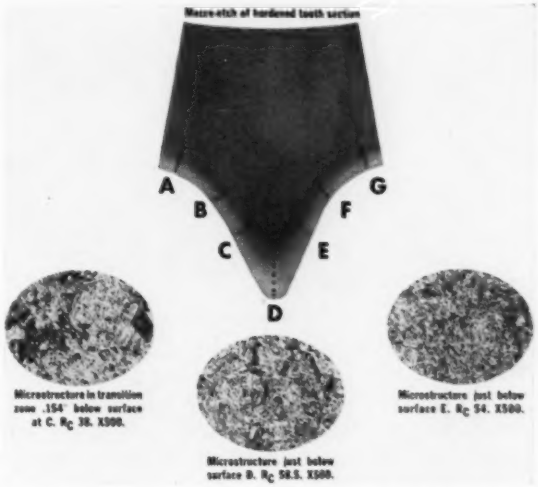

Fig. 4—Macro-etch and microstructures of a surface hardened SAE 1045 cast steel sprocket.

The Selas combustion controller, incorporated in this unit, exercises both physical and chemical control over combustion reactions. Physically, the controller makes gas-air mixtures available at pressures sufficiently high to produce fast heating rates, and holds those pressures sufficiently constant to steady the heating. Chemically, the controller supervises air-gas ratios and so governs, to a large extent, both combustion speed and efficiency. This ratio control provides a protective atmosphere with elimination of free oxygen.

Up to 25,000 cubic feet of mixture per hour are available for any desired gas-air ratio. The ratio control is extremely important. A mixture which is too lean (excess air) will promote excessive scaling of the surface. A mixture which is slightly rich (excess gas) provides maximum combustion speed and efficiency plus maximum surface protection through elimination of free oxygen in the products of combustion. By proper controller setting, these characteristics of the combustion reaction are brought to the optimum point. All burners are supplied from one positive type combustion con-

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Facts and Figures on

HEAT TREATING COSTS

By **HORACE C. KNERR***
President, Metlab Co.
Philadelphia 18, Pennsylvania
Member, Metal Treating Institute

The commercial heat treater encounters many knotty problems in his daily work. One of the most discouraging is the case of the customer who becomes misled by erroneous figures, or by over-optimistic statements of equipment salesmen, into the belief that he can save money by doing his own heat treating. Of course, there are many in-line or in-plant installations where heat treatment is an economical practice. For example, manufacturing industries where masses of repetitive work are regularly put through large continuous furnaces.

But in a great majority of cases, especially in small and medium sized plants where volume allows only intermittent furnace operation, and especially where there is a considerable variety of parts and types of metal and kinds of treatment, an honest, capable analysis will usually show that a competent commercial heat treater will do the job at a far lower overall cost. The reasons for this are numerous and sound but space does not permit elaborating upon them here.

The tragedy of incorrect assumptions in estimating heat treating costs often culminates in the purchase of equipment, which, though good in itself, is either unsuited or needlessly expensive for the actual amount of work to be done. It then becomes a white elephant, sacred to those who approved the requisition, but costly to keep and feed.

* *Mr. Knerr is a Consulting Metallurgical Engineer; Past President of the Metal Treating Institute; Past Chairman, Phila Chapter, American Society for Metals; Former Director, Evening Metallurgical Courses, Temple University; Former Chief Metallurgist, U. S. Naval Aircraft Factory.*

What Are Heat Treating Costs? This is a complex and difficult problem and one that has puzzled many accountants. Striving for detailed accuracy leads to confusion and excessive paper work. One simple and effective yardstick is to compare the monthly or annual bills of the competent commercial heat treater for a given line of work, with the overall cost of installing, maintaining and operating heat treating facilities in the industrial plant. These figures must include not only fuel, maintenance and reasonable depreciation charges, but also the expense of keeping trained, experienced heat treaters on the payroll; having metallurgical talent in the plant to investigate and correct the invariable difficulties that turn up, and the space required for the equipment which might be used for regular production. In addition there is the very important charge of plant overhead, which is too often minimized or ignored.

Now You See Them and Now You Don't Typical of the failure to give careful consideration to all factors involved in heat treating costs is the reported case of an installation of new heat treating equipment at the plant of a mid-western manufacturer. This report received wide publicity in trade publications some months ago as allegedly saving over $3,000.00 a year in heat treating costs, compared with the cost of sending a majority of the work to a commercial heat treater. The picture presented in various magazine articles by the author is so divergent from known factors and so unjust to the reputable commercial heat treating

industry that we feel compelled to comment upon it here.* For clarity, a digest of the essence of this report is given below:

ABSTRACT

Ten thousand pounds of various parts and materials were being heat treated outside the plant by a commercial heat treater at an annual cost of $6,287.80. This amounted to 40% of the total heat treated output. The remainder was being done at the plant in seven obsolete oil-fired furnaces. The scrap rate on work treated outside the plant amounted to $3.46 per hundred pounds while the scrap rate of work done in the plant came to only $0.37 per hundred pounds. The quality of outside work was "poor" and a substantial number of parts were being replaced in the field for reasons definitely attributed to improper heat treatment.

Heat treating operations included carburizing, cyaniding, hardening, drawing, normalizing, etc. Bend-forming and shrink-fitting were also done in plant furnaces. To meet these needs the Company purchased four furnaces—two salt pots for cyaniding and neutral hardening, and two oven-type furnaces for pack carburizing, tempering, drawing, and forming. These were considered adequate for all production requirements, both present and anticipated.

Past experience with fuel oil costs led to the selection of gas for fuel, as being cheapest. However, in view of possible curtailment in the availability of natural gas, it was decided to have one of the furnaces utilize electricity.

The following table purports to represent a "detailed" breakdown of "equipment and operating" costs, after a period of continuous operation, with a claimed saving of $3,040.20.

"COST BREAKDOWN"

Cost Items	Old Equipment	New Equipment
Cost of outside heat treating	$6,287.80	$3,184.60
Depreciation (15 years)	———	908.54
Personal property tax @ $1.50 per $100 on 50%	———	51.11
Insurance $0.21 per $100	———	14.36
Maintenance labor	109.80	82.43
Maintenance material	564.50	423.38
Supplies	407.50	407.50
Fuel, oil	1,274.50	
Fuel, gas	———	682.40
Power, electricity	21.75	312.50
Air	455.00	70.50
Spoiled work, Company	55.00	55.00
Spoiled work, outside	346.89	34.69
Interest on investment @ 3¾%	———	255.53
"Total Costs"	$9,522.74	$6,482.54
"Savings per year"		$3,040.20

"Let's Look At The Record" Let us consider the "facts and figures" given in the aforesaid article. Instead of the substantial "annual saving" claimed, it is very likely that the overall cost for heat treated parts was considerably *increased* by the attempt of the Company to do its own heat treating.

** Ed. Note—This manuscript was submitted to the author of the articles mentioned on September 25, 1953. No reply received to date.*

Still more regrettable is the unfounded and unfair reflection upon the Commercial Heat Treating Industry. To say that scrap losses from a commercial heat treater averaged $3.46 per hundred pounds of work is completely at variance with the established record of the metal treating industry. A recent survey by the Metal Treating Institute showed losses (claims for the value of damaged work) to equal only a *fraction of one per cent* of the amount of heat treating charges. Either the author's figure is based on an abnormal condition or he should have found a competent commercial heat treater.

At one point the author reports original Company-owned equipment to be "inefficient" and says "manual furnace controls allowed too much fluctuation in temperature," while at the same time he claims scrap losses of only one-ninth that of work done outside. He says that a substantial number of parts had to be replaced in the field due to improper heat treatment. This reflects seriously upon the inspection methods of his Company.

The author comments upon the "high cost of oil" as a fuel. This is an unjustified statement. Each source of heat,—electricity, gas, oil and even coal is economical under some set of conditions. Natural gas is a highly desirable fuel when and where it is available, but it too, has a serious fault where supply may be seasonally interrupted, as the author mentions. But instead of having one of two ovens operating on electricity as a standby, and thereby continually incurring the relatively higher costs of electricity intermittently used, would not stored liquid propane have been economical?

What Are The Real Facts? The most serious criticism of this report must be directed to the table of supposed "Cost Savings," purporting to represent "facts" derived from an "organized, thorough analysis."

The author says that 10,000 lbs. or more was heat treated outside and that the cost thereof was $6,287.80. This would average nearly $0.63 per pound, plainly an unrealistic figure except where the parts are of such a nature as to require a great deal of individual hand work. (But in that case, proportionately higher costs would also have occurred in the manufacturer's own plant). Normal commercial heat treating in job lots of the kind described is more likely to cost in the neighborhood of $0.10 to $0.20 per pound. Correction of the figure $6,287.80 to the more probable one of $1,000.00 to $2,000.00 for 10,000 lbs. of work would, of itself, change the claimed saving of $3,040.20 to an operating *loss* of $1,000.00 to $2,000.00.

The figure $3,184.60 listed as the cost of outside

(Continued on page 35)

Ed. Note: The general use of standby plants was described by the author in an article which appeared in the January-February, 1953 issue of *METAL TREATING.*

Propane-Air Gas Standby Plant

PROTECTS OUTPUT OF NEW WIRE MILL

By **PAUL E. PEACOCK, JR.**
President, Peacock Corporation
Westfield, New Jersey

Late in 1952 Crucible Steel Company of America completed a new fine wire mill addition to their Sanderson-Halcomb Works at Syracuse, N.Y. This new mill was designed and constructed for the exclusive production of a special fine gauge stainless steel wire to be used in a new type communication cable. The stainless wire, with a tensile strength of approximately 300,000 psi conforms to AISI Type 302 (18% Cr.-8% Ni.). The final product leaves the mill with a diameter of .015".

All of the heat treating equipment at this plant is natural gas fired used on a interruptible rate basis. A propane-air gas standby plant was installed to assure a continuous supply of gas to the mill at all times.

The manufacture of fine wire begins with ¼" diameter rod delivered from the rod mill and welded into rolls of about 450 lbs. The rod is annealed in a batch type furnace, as shown in Fig. 1, and then water quenched. Annealed rod is pickled in hot caustic followed by several water rinses and an acid rinse after which it is lead coated for lubrication during drawing.

The ¼" rod is cold drawn through a five-pass Vaughn machine to a diameter of .100" using tungsten carbide dies. The wire is then de-leaded for further annealing in a twenty-tube continuous strand annealing furnace. A protective atmosphere of hydrogen is used during annealing. The furnace used is shown in the center background of Fig. 2

Fig. 1—Rod used in the manufacture of fine wire is annealed in batch type furnaces as shown here. All furnaces are natural gas-fired.

and has a capacity of 450 lbs. of wire per hour.

The procedure of annealing, coating and drawing is used to draw the wire to .051" and then .033" after which it is reduced to .015" in diamond dies, without previous annealing. The wire is then shuttle-wound onto spools.

The protective atmosphere in the strand annealing furnaces is produced by one of two Electric Furnace Company anhydrous ammonia dissociators. Each unit will deliver approximately 1000 cfh of a mixed gas containing 75% hydrogen and 25% nitrogen. The original installation of the dissociator was served by the conventional 150 lb ammonia cylinder hook-up. Crucible soon found, however, that this method of operation was prohibitive and therefore installed a bulk anhydrous ammonia tank

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The author is a nationally recognized authority in the LP Gas engineering field. Since 1930 he has designed nearly 100 peak-load and standby LP Gas plants and anhydrous ammonia bulk plants including several in foreign countries.

Fig. 2—After each draw, except final one, wire is annealed in the tube type furnaces shown here. Note the method of feeding wire from individual reels into the furnace tubes.

and tank car unloading facilities. The savings from this installation amount to about $18,000 per year and will very nearly pay for the installation cost the first year of operation.

Propane-Air Gas Standby Plant

Fig. 3 shows the two 30,000 gallon (water capacity) propane storage tanks which serve this installation. The two propane tanks have a capacity equivalent in Btu to about five million cubic feet of natural gas. The tanks are complete with necessary relief valves, excess-flow valves, shut-off valves, pressure gauge, liquid level gauge and other equipment to comply with insurance and safety rules. A pressure reducing station is mounted on top of one of the tanks which reduces the vapor pressure to 10 psig before it is piped to the mixing equipment. A vaporizer is installed adjacent to the tanks and is steam heated to provide proper vaporization of the propane liquid in cold weather.

Unloading Propane

Propane liquid is shipped in 10,000 gallon propane capacity railroad tank cars under pressure. All connections in the tank cars are in the dome section and liquid is withdrawn by eduction tubes. To accomplish this, the unloading compressor transfers vapor from the storage tank to the top of the tank car until a differential pressure in the tank car of about 25 psi is formed. This starts the liquid flow up through the eduction tubes and to the storage tank. It usually requires 3 to 4 hours to unload the tank car.

When the liquid is all unloaded, there still remains a considerable amount of propane in the tank car in vapor form. To reclaim this vapor, the liquid lines are cut off and a 4-way valve on the unloading compressor is reversed so that the compressor now takes vapor from the tank car and transfers it to the storage tank. Depending upon the pressure in the tank car this operation usually requires about three hours, so that the total time required to unload a tank car and reclaim the vapor is about 7 to 8 hours.

Fig. 3—These two 30,000 gallon capacity tanks hold the equivalent of five million cubic feet of gas. Vapor pressure is reduced to 10 psig before piping to mixing equipment.

Propane-Air Gas Mixing Equipment

Propane-air gas is to be used at 20 psi in the Crucible plant mains and therefore it was necessary to install a compressor. Fig. 4 shows the mixing installation and ample space is available for additional equipment if future needs dictate it.

Propane vapor enters the mixing room at 10 psi and is reduced by a second stage regulator to 5″ wc. A diaphragm relief valve in the low pressure line protects the zero regulator which further reduces the vapor to zero pressure at the inlet of a Kemp Series S industrial carburetor. The Kemp diluter mixes the propane vapor with the proper quantity of air to form the desired Btu of mixed gas. The Kemp is directly connected to the compressor inlet surge tank where the compressor pulsations are smoothed out. The suction of the compressor draws the vapor and air through the valves of the Kemp unit and compresses the mixed gas to the

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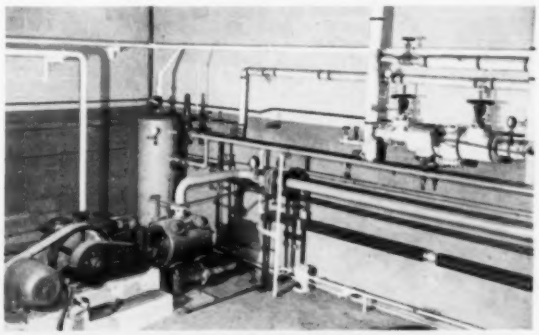


Fig. 4—A view of the mixing equipment required for this installation. Propane vapor enters at 10 psi and is delivered at 20 psi after mixing.

CONTINUOUS RECIPROCATING FURNACES

By **F. C. SCHAEFER**
Sales Manager
American Gas Furnace Company
Elizabeth B, N. J.

The basic principle of a reciprocating furnace consists of imparting a forward momentum to hearth and work and then to suddenly interrupt the forward motion of the hearth. The work slides forward by its own momentum on the hearth until friction between the work and the hearth stops the work. This process is repeated at frequent intervals and thus the work is advanced "step by step" through the furnace.

Care is taken to start the forward motion of hearth and work more or less gradually so that the relative position of the two is unchanged until the above mentioned interruption moves the work. It will be seen that if the forward motion is too sudden that the work remains still from inertia, and the result is opposite to that desired.

In some reciprocating furnace designs the work is advanced in a converse manner by suddenly moving the hearth backward to accomplish the desired purpose. Of course, this method will require considerably more force to be exerted by the activating mechanism than the gradual acceleration method.

A cam, lever and spring arrangement is the mechanism most commonly used with a freely suspended anvil accepting the blow of the hearth to cause the sudden stopping. However, other means, such as air cylinders, are also used.

This motivating principle, although similar in effect, should not be confused with the widely used vibrator style of conveying system where the frequency is hundreds of times faster and where the work is advanced by small "hops" instead of "slides." Experience has shown that, whereas hot heat-resisting alloy will withstand the seemingly destructive pounding of a reciprocating machine for years, it will not so readily withstand the fatiguing effect of the vibrator. Another interesting factor governing the application of vibrators to furnaces is that hot alloy is semi-plastic and, over lengths of two feet or so, absorbs movements of high frequency and low amplitude, sometimes even causing the work to feed a certain distance and then back up and mysteriously return to the feed point.

The reciprocating furnace was first introduced by the American Gas Furnace Company in 1921. The first machine, shown in Fig. 1, was gas fired and had an alloy hearth with a heating space of 12" by 56" long. The work was exposed to the products of combustion, but excessive scaling was prevented by maintaining a reducing adjustment of the firing burners. This particular size of machine was widely used for many years to heat treat such work as pen points, shoe shanks, needles, horseshoe caulks,

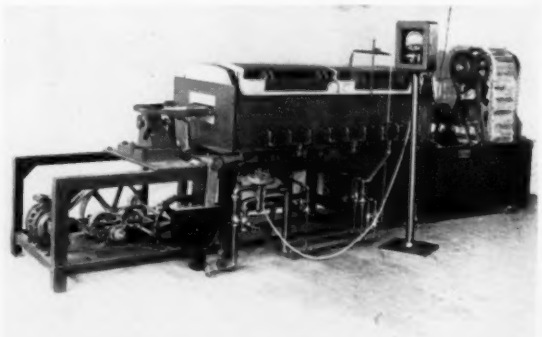


Fig. 1—An early photograph (1922) showing the first reciprocating heating machine. Note the simple motivating mechanism. Also illustrated is an early style continuous quench tank with a rotary drum and a lift bucket conveyor.

screws, bolts, etc. It is interesting to note that production rates up to 40 or 50 pounds per square foot were achieved on certain kinds of work.

About 20 years ago, through a desire to control more completely the gaseous atmosphere surrounding the work, the design was changed to include a muffle instead of a hearth, with a muffle plate seal at the discharge end of the machine. The discharge chute, connecting the furnace and the quenching tank, was tightly fastened to the bottom of the furnace, and its lower end was immersed in the quenching medium. A small amount of furnace combustion products sometimes entered the muffle, but if a sufficient amount of muffle or atmosphere gas was used, it minimized any deleterious effect.

Several sizes of machines were also made to meet the wider application of the "Shaker." These ranged from a small furnace with a muffle about 4" wide and 18" long to a unit 24" wide and 12 feet long, capable of producing up to 1000 pounds per hour. Work sizes ranged from stainless balls 1 mm. diameter to tank track links weighing several pounds each.

The usual stroke varies from about ½" to 1¼", and the frequency anywhere from 10 to 120 strokes per minute. When it is desired to lengthen furnace dwell time for deeper case hardening, etc., an interrupter timer is used to suspend the strokes completely for various intervals.

Striving for perfection, many efforts were made to improve the seal at the discharge end so that absolute control of muffle atmosphere could be obtained. At first, it was feared that if the downward discharge portion of the muffle were continued down and flanged to a sheet metal extension immersed in the quench that the forward motion and sudden stop of the muffle would encounter great resistance in the quench and thus flex or break off the hot metal. However, trials showed that the resistance in the quench was negligible, and this design has now been standard for several years. As a matter of fact, one or two installations exist where a full muffle extension is reciprocating with the discharge immersed in a molten salt bath quench for martempering or austempering.

Some manufacturers achieve full atmosphere control by using a plain hearth in the machine and heating by means of radiant tubes. Thus, the entire heating chamber becomes the atmosphere chamber. Published production figures indicate, however, that the full muffle machine can produce considerably more pounds per hour per square foot of hearth than the radiant tube unit.

This type of furnace has a number of advantages, which may be enumerated as follows:

Uniformity—On production work, each piece goes through the same treatment as the piece preceding and the piece following. Each piece receives what amounts to an individual quench.

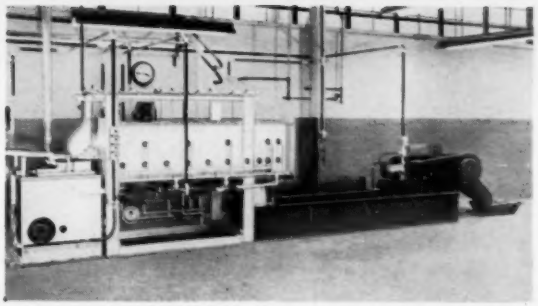


Fig. 2—A modern reciprocating hearth heating machine installed with continuous automatic quenching tank at the plant of the Crouse-Hinds Company, heat treating electrical connection fittings in a controlled atmosphere. This machine produces up to approximately 250 pounds per hour.

Thermal Efficiency—Only the work enters and leaves the heating chamber. No belt or conveyor removes heat and uses fuel.

Simplicity—There are no wearing parts in the heat, making for easy and uncomplicated maintenance when necessary.

Versatility—Experience has shown, for example, that one size of machine can handle work from steel pen points to bolts 1½" diameter by 6" long, with heating time from two minutes to one hour, varied at will.

Atmosphere Control—The gas surrounding the work is exclusively that which is purposely introduced. Any kind of process can be easily handled, including bright hardening, nicarbing, carburizing, etc.

Many hundreds of these furnaces are in constant daily use, and many additional installations by manufacturers attest to their effectiveness. They find application especially among commercial heat treaters where small and varied production lots are frequently required to be treated.

Among users are particularly found makers of screws, bolts, nuts, fasteners, etc., small hardware, tools, chain and bearings. Typical installations are shown in Figs. 2 and 3.

An interesting adaptation is found in heat treating balls, where the hearth or muffle is supplied with cross grooves so that balls travel by jumping from one groove to another at each stroke. Longitudinal grooves are also used to assure end quenching and proper distribution of long thin work, such as ice picks, pointed goods or needles.

When considering the application of this type of machine to various tasks, it is important not to select too large a unit for the light work which should have a short heating time, but to select a shorter unit which doesn't have to be stroked too hard to accomplish the transfer of the work in the short time desired. Usually speaking, the 3½ ft. unit is recommended for heating cycles of two minutes and longer, 7 ft. from four minutes up, and 9 ft. from eight to ten minutes and longer. These esti-

(Continued on page 14)

Continuous
ROLLER HEARTH FURNACE

By **A. R. ROBERTSON**
General Manager, Wayne Industrial Furnace Company
Highland Park 3, Michigan

The continuous industrial furnace, being automatic in its function, is one that is required to produce a certain specified heat treatment of parts by a uniform procedure at a given rate, in a given time, and at a minimum of cost. Furnace units may perform more than one operation and may vary in design and method of the handling of the parts. Application of type or kind of a furnace is governed to a large extent by the design of the work, the treatment required, its serviceability, and cost.

The continuous roller hearth furnace is one where the work is placed in baskets or on trays that are conveyed through the furnace on driven rolls. These rolls usually have guide flanges to direct the work in its travel and to prevent it bumping into side walls.

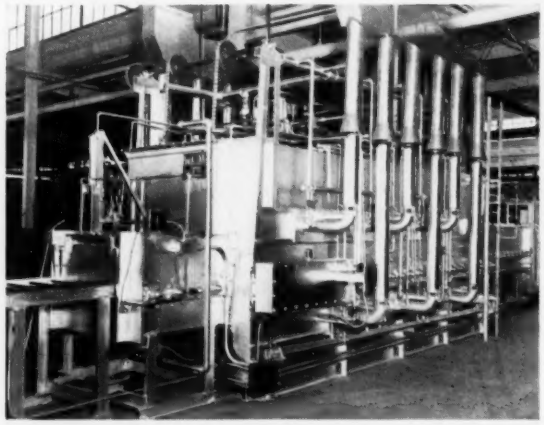


Fig. 1—Charging end of a roller hearth furnace for bright annealing copper and steel gaskets. Equipment is cross-fired under and over the roller hearth.

Advantages Of The Roller Hearth

By being motor driven through a reducer and a variable speed reducer, the speed of the rolls or travel in the furnace can be easily varied to change cycles of timing. Transfer of work, from an enclosed compartment or through a certain zone, is accelerated to avoid loss of time, heat, or atmosphere.

Maintenance of this type of hearth is less costly in time and money as the rolls can be individually removed with very little effort and without prolonged shut down. This type of furnace offers an unobstructed space under the rolls for heat circulation (assisting uniformity) and easier cleaning of the furnace bottom when and if necessary.

With the roller hearth, a definite saving of heat and furnace atmosphere is had because of the ease of transferring the work through enclosed vestibules, heating zones, or cooling zones by being able to practically seal the various compartments, one from the other. This again, is a big factor in maintaining uniformity of treatment.

Some furnaces using belts or chains as a means of conveyance, have a heat drag-out. Heat is not only lost by the hot belt or chain leaving the furnace but it must be reheated upon re-entry into the furnace. By use of the roller hearth this adds a considerable saving in fuel.

As compared to the pusher type furnace, the cost of work baskets or trays is less because they can be made lighter, as they are designed to carry a given load at a given temperature and do not, in addition, have to have sufficient strength to with-

stand the intermittant pressure of a pushing load.

Description Of Furnace

Figs. 1 and 2 show a roller hearth furnace for the bright annealing of copper or steel gaskets and may be operated at temperatures ranging from 450° F. to 1600° F. This unit has a charge table, a charging vestibule, a radiant tube gas fired heating furnace having two heating zones and one unheated neutral zone, water cooled cooling sections, a discharge vestibule, and a discharge table.

Fig. 2—View of the discharge end of the furnace shown in Fig. 1. The equipment incorporates a water-cooled cooling section.

Fans are installed in the heating zones and cooling sections to assure uniformity and more efficient heating and cooling.

The rollers are mounted in special water cooled bearings in the heating zones. These bearings are made gas tight by being gasketed and capped on one side of the furnace, while on the other side, where the sprocket drive is attached, the roller ends are in a gasketed compartment extending the length of the furnace.

This being an atmosphere furnace, gas fired radiant tubes are used, equipped with special burners, electrically piloted, with combustion air supplied from a blower mounted over the top of the furnace.

All doors are air operated and at such points, over-drives are used in connection with the rollers to rapidly transfer the work through the doors so that door openings are held to a minimum of time.

Vestibules are purged of all air before work is transferred into or from them by means of timers. The furnace and coolers are under atmosphere all during operations.

The cooling sections are water cooled on all four sides and have valved pipe lines to control water supply and the degree of cooling. Thermometers may be installed in each zone to control water temperature.

Accessory Equipment

An exothermic gas generator is installed adjacent to the equipment which supplies either a rich or lean gas that is readily controlled to provide the correct atmosphere depending on the kind of work being processed.

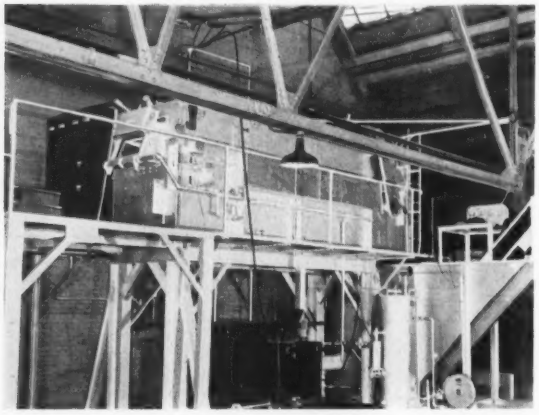
A refrigerating unit is installed at the outlet of the generator to bring the dew point of the gas down to +40.

Furnace equipment with its accessories are machine tools, and when a manufacturer determines his requirement of a specific treatment or process, it is the furnace builder with his skill, knowledge, and experience that is in the position to correctly engineer and design the equipment to produce such for economical operation. In design and operation furnace equipment possesses the characteristics of a machine tool and should be cared for as such if long life and efficiency is to be obtained from it. ■ ■ ■

Ed. Note: *Many readers have written us expressing their interest in the articles which have appeared in this and the previous symposium on batch type furnaces. In view of this, consideration is being given to the preparation of a book containing all those articles on furnace equipment which have appeared in previous issues of METAL TREATING. If you feel that this book might be of help to you, we would appreciate your comments.*

Furnace Features Feet

The Saint Joseph, Michigan, plant of the Auto Specialties Manufacturing Company, a large manufacturer of parts used in automobiles and tractors, was faced with the problem of positioning a Lindberg electric conveyor atmosphere hardening furnace. Since this plant is located on sandy soil just off the shores of Lake Michigan, water would be encountered if a pit was dug for the quench tank. In addition, mobility was desired to allow for subsequent repositioning of the unit if the need arose.



Their solution was to place the 17,400 lb. furnace on an inexpensive scaffold that could quickly be dismantled. Large containers holding the work to be treated are hoisted to the loading platform by a lift truck where the operator shovels it into the furnace. After treatment, work drops from the conveyor belt into the quench tank where a flight conveyor drops it into a steel chute leading to tempering baskets. This solution also lends itself to space savings since atmosphere generators, control panels, etc., can be placed under the scaffold.

IMFA Looks Forward to Modernization

Modernization will be the promotion theme of the industrial heating industry in 1954, according to Carl L. Ipsen, executive vice-president of the Industrial Furnace Manufacturers Association.

"Progress in metallurgy during and since World War II has been greater than many manufacturers and engineers realize," Mr. Ipsen said. "Old heat-treating equipment which may not wear out in a lifetime is obsolete and prevents users from taking advantage of modern technology. We are setting out as an industry to educate users and potential users on the new technology and the advantages of it."

Industrial heating equipment sales for 1953 were about 150 per cent above the volume of 1940, according to Mr. Ipsen. As a result of the trend toward more heat-treating, he expects the industry to out-perform other capital goods industries in the years ahead.

Modernization and replacement was the theme of IFMA's annual meeting at Philadelphia in January. In May the leaders of the industry will gather in Hot Springs, Va., for a three-day meeting to analyze and improve their company sales and advertising methods.

"In a buyers' market," Mr. Ipsen said, "more emphasis must be placed on quality. One of the best ways to improve quality of many products is through heat-treating. Industrial heating equipment should be used more widely than it is and the obsolete equipment must be replaced if American industry is to take advantage of the best available technology."

New Oil Burner Design

A new oil burner design incorporating the use of a high temperature, high strength alloy for the combustion chamber has been developed by Mr. Don Taylor, Box 177, St. Catherine's, Ontario. The burner is built around a single piece cast chamber which is said to increase burner efficiency.

A heat resistant type of Meehanite metal is used for the combustion chamber which, as seen in the accompanying illustration, resembles a tear drop in form. This shape was developed to create the most effective mixing of fuel oil and air for proper com-

(*Continued on page* 14)

The Park Neutra-gas Story:

No sludge, no de-carb in neutral salt baths rectified by Ansul methyl chloride!*

A patented development of Park's research laboratory, the Neutra-gas process efficiently and economically neutralizes chloride base salt baths . . . maintaining them free of de-carb in temperatures ranging from 1350°F. to 2300°F. The decarburizing oxides present are chemically converted back to chlorides by passing methyl chloride through the molten baths.

No solid rectifiers and their subsequent sludging are needed. No fresh salt additions are required except to replace drag-out. Fluidity of salt is maintained like new and sluggishness caused by solid rectifiers is eliminated.

Complete details of the Neutra-gas process plus valuable information on neutral salt baths, their operations and uses, are described in a technical bulletin available to you by mailing the attached coupon.

* Truly neutral chemically. Alkalinity can be maintained at zero.

At Commercial Steel Treating Corp., in Detroit, salt bath furnaces are daily cleansed of all impurities. Rectifying gas is bubbled into Park Nu-Sal Neutral Salt molten at its operating temperature of 1500°F.

Even high-speed hardening baths up to 2300°F. are easily maintained neutral. At Commercial, both pre-heat and high heat are rectified daily to zero alkalinity. Rectification is at 1850°F. in the high heat, done either on idling time or when furnaces are being used for hardening high carbon, high chrome die steels. Salt is Park Pre-heat 117, and Park High Heat 175-S.

Ansul Methyl Chloride (CH_3Cl) is a liquefied gas, 99.98% pure (by weight).
Patent number — 2474680 — Neutra-gas Process license fee, $25.00 per year.

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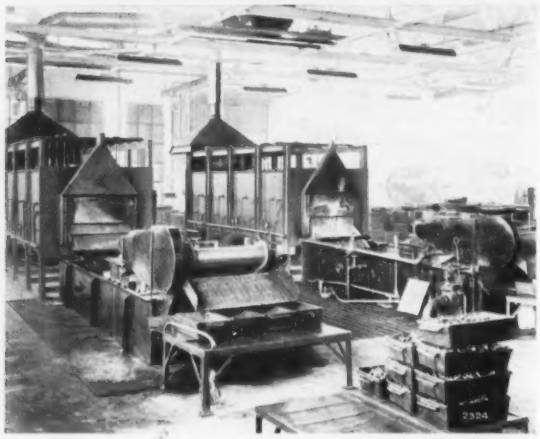


Fig. 3—A view showing the discharge end of two 1000-pound Shakers at the plant of the Clark Brothers Bolt Company, Milldale, Conn. These furnaces are equipped with hearths instead of full muffles.

mated times are strictly arbitrary because records exist, for example, where heating times of five minutes have been continuously maintained in a 9 ft. furnace.

Seeking continuously to improve, a new design has recently been introduced in which the fully sealed muffle is maintained stationary and a lighter hearth reciprocates inside on free rollers to convey the work. This offers several advantages, such as the ability to remove the hearth to clean its surface, or for straightening, or minor repairs, and the fact that a smaller amount of weight need be started and stopped. A unit of this type is illustrated in Fig. 4. Additionally, this newer design saves the full muffle floor from thermal quenching, which is withstood by the hearth only and which member, being only a channel shape, is free to articulate accordingly; greatly increased muffle life is expected in this style. Shorter heating times in larger furnaces can also be maintained without overtaxing the mechanism. ■ ■ ■

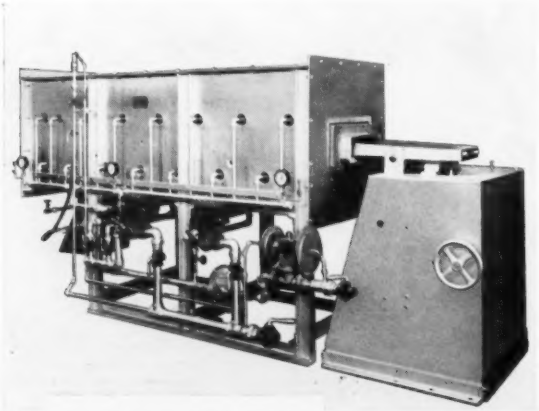


Fig. 4—The latest design machine with stationary muffle and movable hearth.

bustion. After initial firing the chamber heats rapidly to a point where the heat of the chamber will support combustion of the fuel mixture.

The use of heat resistant metal for the combustion chamber is reported to provide a number of advantages over conventional burners, among these are: chambers will heat up and support combustion in one-fifth the time required for refractory type burners; a rapid rate of heat exchange from the burner; quieter operation due to the greater damping capacity of Meehanite metal; longer burner life; better temperature control due to faster heat transfer; and savings in fuel costs due to overall greater efficiency.

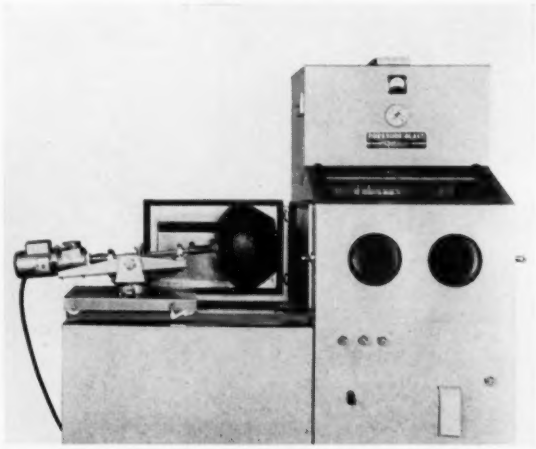
New President of Electro-Alloys Division

American Brake Shoe Company has appointed Charles M. Ruprecht president of its Electro-Alloys Division. He was formerly vice-president of the division.

After graduation from college, Mr. Ruprecht joined the Jones & Laughlin Steel Corporation and then served four years in the Navy. In 1946 he joined the American Manganese Steel Division of American Brake Shoe Company as an apprentice and in 1947 was promoted to sales engineer. In 1950 he became sales manager of the Electro-Alloys Division. This division, located in Elyria, Ohio, manufactures heat and corrosion resistant alloy castings.

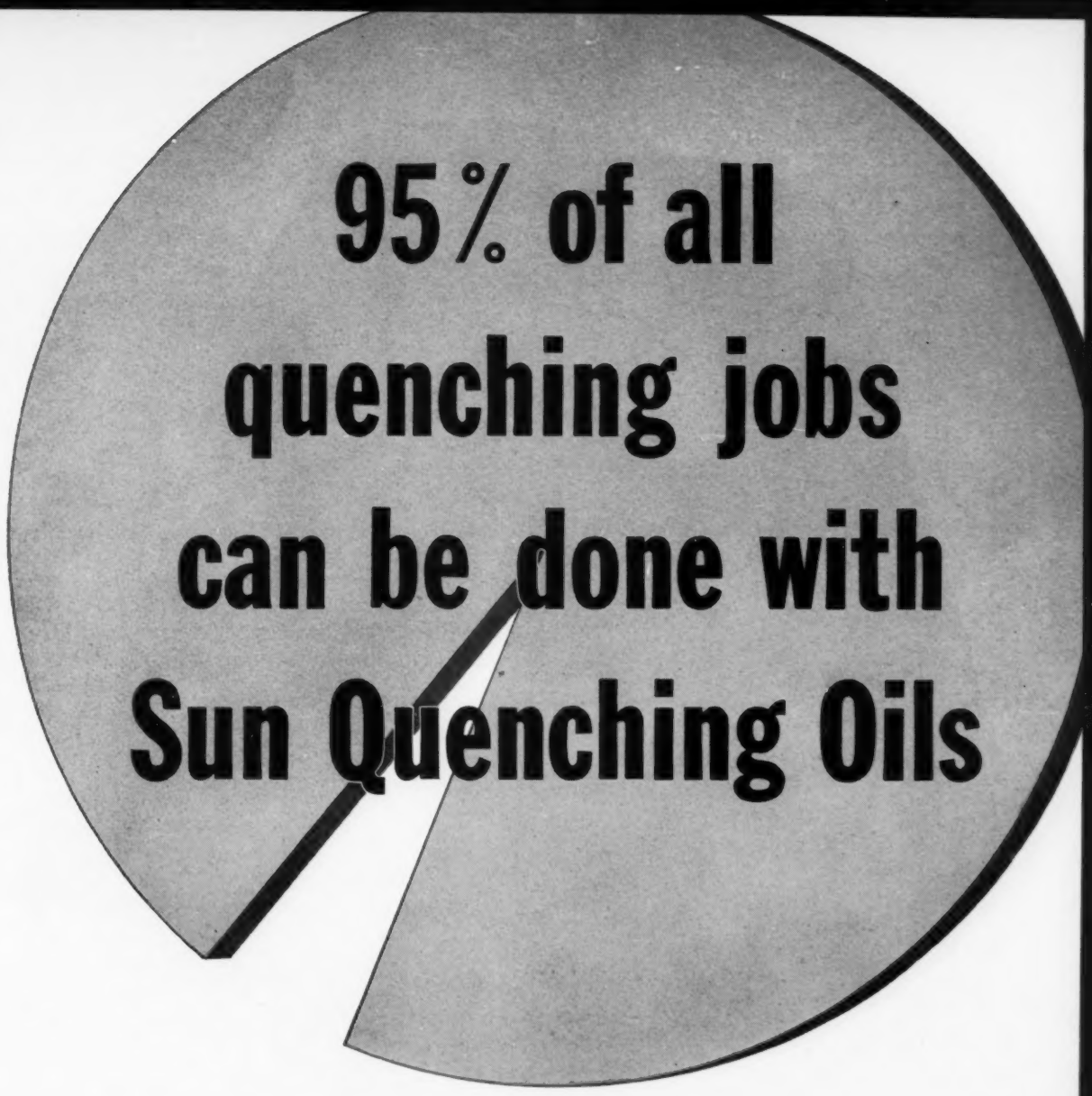
A graduate of Yale University, Mr. Ruprecht is married and lives in Cleveland, Ohio.

Wet-Blast Unit



The addition of a new model to its line of wet-blasting equipment has been announced by the Cro-Plate Co., Inc., 747 Windsor St., Hartford, Connecticut.

(*Continued on page* 16)



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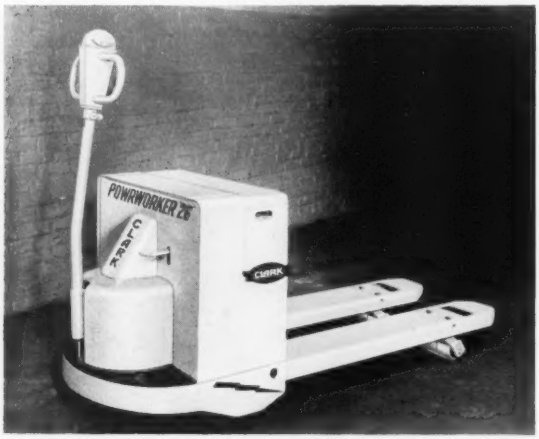
News to Heat Treaters (cont'd)

Known as the Pressure Blast Roto-Barrel, the unit was designed for bulk, high-production rate finishing, descaling or deburring of small parts. The work is loaded into an expanded metal, plastisoled barrel and rolled into the interior of the cabinet where the blast gun, in a fixed but adjustable position aims in the open end. A variable speed drive rotates the barrel exposing the parts to the blast stream. Following the wet-blasting operation, the barrel is manually rolled out of the cabinet and the work is rinsed free of abrasive slurry at the machine.

New Line of Powered Hand Trucks Announced by Clark

The Clark Equipment Co. Battle Creek, Mich., has announced a new line of powered hand trucks for materials handling, designated "Powrworker 26."

Features of the new trucks are a short overall length, maximum load stability, and several new safety factors.



A low center of gravity, giving the truck a high degree of load stability, was gained by locating the battery in an underslung position close to the floor. The brake operates on the motor shaft, transmitting the braking effort from the source of power through the gear ratio of 22 to 1. The brake is spring applied and actuates a deadman switch which automatically breaks the power circuit when the steering handle is in a vertical or horizontal position. When the operator releases the handle, it automatically returns to the vertical position, which eliminates an obstruction hazard common to trucks whose handles remain horizontal.

The drive unit of the new hand truck is supported in the truck frame by an arrangement of wide-spaced thrust and radial roller bearings, providing easy steering regardless of load or operating conditions.

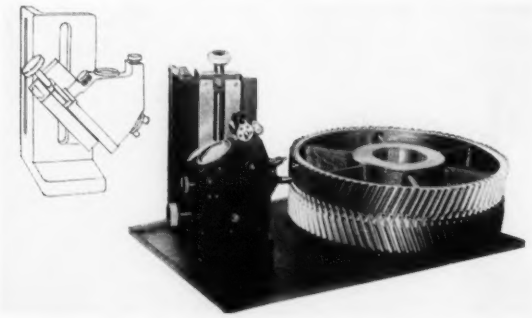
All hand trucks in the new line can be ridden by the operator. The complete line includes low lift pallet and platform trucks in both 4000 and 6000 lbs. capacities; telescopic tilting fork trucks in four base capacities; as well as a walk-it or ride tractor designed for either slow or high travel speeds.

New Representative Appointed

The Stanwood Corporation, manufacturer of heat treating equipment, has announced the appointment of Mr. Charles Plant, Jr., as sales representative for the Ohio area. Mr. Plant maintains offices at Alloy Sales and Service, 8905 Lake Ave., Cleveland 2, Ohio.

Semi-Portable Hardness Tester

A new multiple angle semi-portable metal hardness tester which does not use clamps, is by C. Tennant, Sons & Co., 100 Park Ave., New York, N. Y. It was developed for testing the many parts and places inaccessible when clamps are employed, but it also has the advantage of being adaptable as a conventional bench-type hardness tester.



The tester consists of a modified portable Penetrascope, movably mounted on a slotted stand, the base of which contains electro-magnets which hold the unit firmly to a surface table, lay-out table, or other ferrous base. The object to be tested is held secure, either by its own weight or mechanically, so that it will not move in relation to the common ferrous base on which the stand is also set.

New Design Tube Mill Furnace

Continental Industrial Engineers, Inc., 176 West Adams Street, Chicago 3, Illinois, has announced the completion of erection of a new type furnace at Colorado Fuel and Iron Corp.'s Minnequa Works in Pueblo, Colorado. Known as Series #2076, this design is the latest addition to a line of large continuous steel mill furnaces featuring automatic handling, labor saving equipment.

This new furnace is approximately 50 feet long by 15 feet wide by 15 feet high and is constructed with 15 horizontal, flanged rolls that receive the

(*Continued on page* 26)

desired pressure. The compressor discharges through a water-cooled aftercooler to a surge tank and then to the plant mains.

Since the plant consumption fluctuates and the capacity of the compressor is constant, a back-pressure regulator was installed to by-pass any surplus capacity and recirculate it through the compressor. This method provides much smoother operation and a more uniform Btu than if the compressor were operated on a load-unload cycle.

A valve in the line at the outlet of the final surge tank is used to regulate the flow of propane-air when only a partial curtailment of natural gas is in force. During 100% curtailment, the natural gas is shut off and the propane plant handles the complete load.

In adjusting the propane-air plant the desired quality was complete interchangeability with natural gas rather than any particular Btu of gas. To effect this characteristic at the initial adjustment, three bunsen burners were installed with individual controls. These were connected and adjusted with natural gas so that one burner gave the desired flame appearance; one was adjusted to give a hard flame (slight excess of air); and one was adjusted to give a slight soft flame (too little air). These burners were connected with pipe lines so that they could burn natural gas, propane-air gas, or a mixture of the two, as during a partial curtailment.

With the bunsen burner arrangement it was possible to adjust the propane-air exactly to give the desired burning characteristics. If the burner adjusted with a slight excess of air should have a tendency to lift, the operator would know the propane-air gas was slightly low in Btu. If the burner that was adjusted with a soft flame developed a yellow tip the operator would know the Btu was slightly high. By these burners the mixed gas so nearly duplicated natural gas characteristics that operators could not tell whether their equipment was burning natural gas, propane-air gas or a mixture of the two.

Starting Up The Plant

After the propane-air gas plant is initially adjusted, the Btu output should remain constant until it is changed manually at the Kemp proportioning valves. Therefore, starting up the plant consists only of opening the propane vapor supply to the Kemp unit and starting up the compressor.

Crucible employees have started up and operated the plant a number of times just to keep familiar with the operations. However, the plant has not had a curtailment in the first year of operation. But, like any other insurance, the propane-air gas standby plant offers protection against possible lost time and lost production in the future. ■ ■ ■

troller and can continue to release heat at a constant rate, regardless of changes in number of burners or change in pressure of an individual burner, up to the controller's maximum rated capacity.

Steady burning rates are depended upon to maintain uniformity of product and uniformity of production time. Shorter and faster heating cycles possess the attribute of exposing work in process to high temperature for a shorter period of time. Detrimental effects of high temperature exposure can be minimized by controlling proportions of combustion gas products.

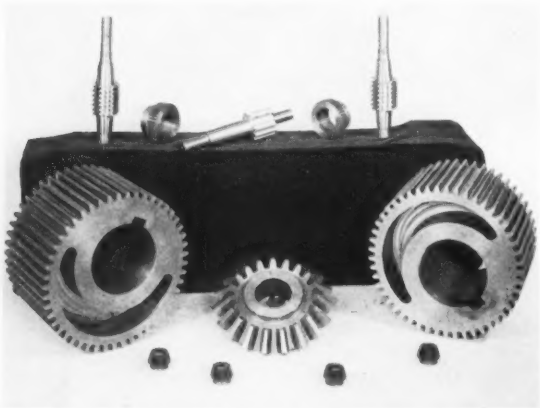


Fig. 5—Variety of parts which can be selectively hardened on the new Wiedemann unit.

Accurate Temperature Control

One of the important features of this hardening method is the electronic temperature control sysem with its Rayotube detector, which must focus on a small area between the burners so it can sight directly on the surface of the products being heated. The Leeds and Northrup Rayotube when exposed to a work piece will indicate within 99% of true temperature within 0.6 second and so responds to the very rapid temperature changes characteristic of flame hardening. It will withstand high ambient temperatures, corrosive gases, etc., without losing accuracy or sensitivity. The double mirror Rayotube is designed to be a narrow angle instrument. Radiation enters the instrument through a window and encounters a concave mirror, which forms an image of the source on a diaphragm on which there is a small aperture. The image of the portion of the source to be measured is made to cover the aperture and the radiation passing through is focused by a second concave mirror on the disc of the sensitive element, where an image of the aperture is formed. The problem of focusing is simple, and the observer can see exactly what part of the surface is being measured, with the assurance that this reading is not being affected by adjacent areas.

The Rayotube is based on the principle of radiation pyrometry by which the amount of radiation given off by a heated object is automatically measured. All bodies, by virtue of their temperature, emit radiant energy from their surfaces to the extent of the heat energy they contain. A highly sensitive thermocouple is focused to receive radiant energy from the rotating work piece during the heating cycle. The electromotive force thus generated is transmitted to a Speedomax temperature recording and controlling instrument. When the surface of the part reaches the desired pre-set temperature, a warning signal is rung. Temperature is so closely controlled that uniform depth of heat penetration is achieved. Fig. 5 illustrates the variety of work selectively hardened on this equipment. ■ ■ ■

Acknowledgement is given by the author to the Selas Corporation, and Leeds and Northrup for assistance in the preparation and review of this article.

eliminate the guesswork in selecting tool steels

Thousands of metal working people are using the Crucible Tool Steel Selector to determine exactly which type of steel they need. This handy selector covers 22 tool steels which fit 98% of all tool steel applications.

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Application — Deep drawing die for steel

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Sub-Group — Special Purpose

Tool Characteristics — Wear Resistance

Tool Steel — Airdi 150

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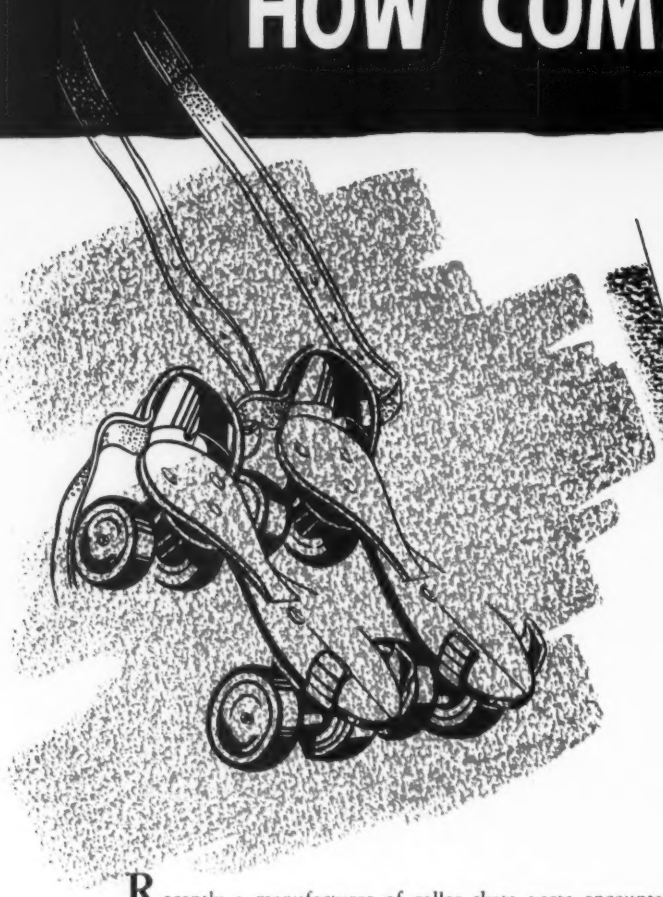
CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

an example of HOW COMMERCIAL HEAT



Firm: [redacted]

Subject: Roller Skate Parts

INCOMING PROCEDURE:

All material as received to be inspected by [redacted] for cleanliness and surface condition for proper heat treating response.

PROCESSING PROCEDURE:

1. Material to be divided into batch lots by [redacted] by heats for uniform case penetration in Dry Cyanider. Lots must be sufficiently small for complete case depth control, i.e., .003" - .007" max. depth.
2. After quench each heat must be inspected by [redacted] for cleanliness, put into a quality Control tote pan, and labelled with a quality Control number. Heat number sheet to be retained by [redacted]
3. A sample piece from each heat, properly labelled, will then be delivered to metallurgical laboratory, [redacted] for case depth determination.

OUTGOING PROCEDURE:

Sample piece, case depth metallurgical report and individual heat lot in tote pans will then be forwarded to [redacted]

N. B. Quality Control tote pans then to be returned to [redacted] for re-use. Empty original containers to go with [redacted] tote pans for re-use by [redacted]

Recently a manufacturer of roller skate parts encountered a great deal of difficulty in trying to find a source of heat treating for a particularly hard job. So serious was the problem that at one time consideration was given to installation of the necessary equipment at the manufacturer's plant. However, equipment would have cost over $20,000 plus the additional expense of labor, plant space, insurance, supplies, and above all, the metallurgical supervision required to control this intricate work properly.

The manufacturer turned to a local commercial heat treater to handle the work and even offered to install the required equipment. However, they were able to handle the job to the utmost satisfaction of the customer, using existing facilities.

The cyaniding operation involved required a case dept of 0.003" to 0.007". Samples of each batch processed are sent outside to a commercial metallurgical laboratory for inspection and testing. After OK, the parts and metallurgical report for each batch are shipped to the customer. The control sheet shown here is actually in use at **the plant now doing the work and conveys** some idea of the thoroughness to be expected fom those commercial heat treating plants which are members of the Metal Treating Institute.

A reprint of the article, "Heat Treaters Cite Short Cuts to More Effective Purchasing" is available from each of the companies listed. This handy reference will prove of value when ordering heat treating.

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1045 No. Orange Drive, Los Angeles 38
Lindberg Steel Treating Co.
2910 S. Sunol Drive, Los Angeles 23
Cook Induction Heating Co.
4925 East Slauson Ave., Maywood
Dexter Metal Treating Co.
1026—77th Ave., Oakland 21
Industrial Steel Treating Co.
1549—32nd St., Oakland 8
Valley Metal Treating Co.
355 So. East End Ave.

COLORADO

Metal Treating & Research Co.
4110 Fox St., Denver 16

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6
Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 5

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Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Chicago Steel Treating Co.
333 North California, Chicago
Cura-Hard Steel Treating Co.
2333 West Deming Place, Chicago 47
Pearson Industrial Steel Treating
5757 Ogden Ave., Chicago 50
Perfection Tool & Metal Heat Treating Co.
1740 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kenzie St., Chicago 22
American Steel Treating Co.
P. O. Box A, Crystal Lake
Klund Metal Treating, Inc.
721 Beacon St., Love Park
Lindberg Steel Treating Co.
1975 No. Ruby St., Melrose Park
T. Muehlemeyer Heat Treating Co.
1531 Preston St., Rockford
U. Scott & Son, Inc.
1510 First Ave., Rock Island

INDIANA

Perl Heat Treat Corp.
1824 So. Franklin St., South Bend 23

MARYLAND

Maryland Tool Company
11-13 Hollingsworth St., Baltimore 2

MASSACHUSETTS

New England Metallurgical Corp.
7 Alger St., South Boston 27
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Acme Steel Treating Co.
119 Lieb St., Detroit 7
Anderson Steel Treating Co.
1337 Maple St., Detroit 7
Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Michigan Steel Processing Co.
3120 Denton, Detroit 11
Standard Steel Treating Co.
3468 Lovett Avenue, Detroit 10
Vincent Steel Process Co.
2424 Bellevue Ave., Detroit 7
State Heat Treat, Inc.
520 32nd Street, S. E., Grand Rapids 8
American Metal Processing Co.
12000 East Nine Mile Road, Van Dyke

MINNESOTA

Metallurgical, Inc.
900 East Hennepin, Minneapolis 14

MISSOURI

Metallurgical, Inc.
1915 Tracy Ave., Kansas City 8
Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15
Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Ace Heat Treating Co.
611 Grove St., Elizabeth
American Metal Treatment Co.
Highway 25 and LaFayette St., Elizabeth
Benedict-Miller, Inc.
Marin Ave. and Orient Way, Lyndhurst
Bennett Steel Treating Co.
246 Raymond Boulevard, Newark 5
L-R Heat Treating Co.
107 Vesey St., Newark
Temperature Processing Inc.
228 River Road, North Arlington

NEW YORK

Fred Heinzelman & Sons
138 Spring St., New York 12
Alfred Heller Heat Treating Co., Inc.
391 Pearl St., New York 38
Metro Heat Treat Corp.
466 Broome St., New York 13
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Rochester Steel Treating Works
962 Main Street, E., Rochester 5
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Cincinnati Steel Treating Co.
Wooster Pike & Mariemont Ave., Cincinnati 27
Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 25
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14
George H. Porter Steel Treating Co.
1273 East 55th Street, Cleveland 3
Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 West Lake Road, Cleveland 16
Dayton Forging & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Robert Wooler
Limekiln Pike, Dresher
J. W. Rex Co.
834 West Third St., Lansdale
The Drever Company
220 West Cambria St., Philadelphia 33
Lorenz & Son
1351 N. Front St., Philadelphia 22
Metlab Company
1000 East Mermaid Lane, Philadelphia 18
Wiedemann Machine Co.
4272 Wissahickon Ave., Philadelphia 32
Ferrotherm Company
4911 Butler St., Pittsburgh
Pittsburgh Commercial Heat Treating Co.
49th St. and A.V.R.R., Pittsburgh 1

TEXAS

Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11

WISCONSIN

Hushek Metal Processing Co.
1536-40 West Pierce Street, Milwaukee 4
Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wesley Heat Treating Co.
1333 West Pierce Street, Milwaukee 4
Wesley Steel Treating Co.
1301-1403 West Pierce St., Milwaukee
Harris Metals Treating Co.
1635 Murray Ave., Racine
Spindler Metal Processing Co.
2338 Mead Street, Racine
Wesley Metal Treating Co.
2320 Mead Street, Racine

MTI
METAL TREATING INSTITUTE

INSTITUTE NEWS

SPRING MEETING AT THE HOMESTEAD

All arrangements have been completed for the 1954 Spring Meeting to be held at The Homestead, Hot Springs, Va., on April 5th, 6th and 7th. Reservation cards are now being mailed to all members with the request that they be returned as soon as possible in order to estimate attendance accurately. The Homestead offers a wide variety of activities for recreation and those member representatives attending can look forward to a very pleasant stay while enjoying the traditional hospitality of this resort.

The Chesapeake & Ohio Railroad will run several special trains from New York City to The Homestead if sufficient reservations are received early enough.

A well rounded program is now being outlined and a thoroughly enjoyable and successful meeting is anticipated. Among the guest speakers will be Mr. Cary H. Stevenson, Lindberg Engineering Company, who will deliver a talk certain to be of interest to all members; its title, "How the Commercial Heat Treater and Industrial Furnace Manufacturer Can Work Cooperatively to Their Mutual Benefit."

PRESIDENT AND EXECUTIVE SECRETARY ATTEND MID-WEST CHAPTER MEETING

On January 15th the Mid-West Chapter met at Neilsen's Restaurant, Chicago, Ill., with President Cook and Secretary Herington attending. Attendance at the meeting was excellent and nearly all member companies were represented. Both Mr. Cook and Mr. Herington addressed the group at the request of Chairman Bob Davis of Perfection Tool & Metal Heat Treating Co.

During the business meeting of the chapter a special assessment was voted for the purpose of providing funds to entertain all members of the Institute at the Annual Meeting to be held in Chicago this year. It seems certain that everyone attending the Annual Meeting will receive a royal welcome.

VALLEY METAL TREATING MOVES

In the month of December, Mr. Bill Farrar, Jr., announced that Valley Metal Treating of Pomona, California, was moving from its original location on Commercial St., to a new plant on South East End Ave. Greatly expanded and improved heat treating facilities are being made available as a result of the move. An open invitation to inspect the new plant has been extended to all members.

LINDBERG STEEL TREATING ANNOUNCES TWO STAFF ADDITIONS

Mr. Carl Meinhard has joined the staff of Mr. Ed Pavesic, Director of Research and Mr. Muhammad Abdur Rashid has joined that of Mr. Norman O. Kates, Chief Metallurgist at the Lindberg Steel Treating Company in Melrose Park, Illinois.

Mr. Meinhard was formerly a metallurgist in the research department of the Rheinische Roehrenwerke A.G., Dusseldorf, Germany.

Mr. Rashid holds degrees in Chemical Engineering and Physics acquired in Pakistan.

MTI MEMBER HONORED

Everyone knows that the talents of a commercial heat treater must be wide and varied and such is the case, of course, with all members of the MTI.

Proof of truly exceptional talent is shown in the illustration below of Old Timer, Fred Heinzelman, Sr., being escorted as an honor guest in a parade in his old home town, Leistal, Switzerland, last summer. The occasion was

the Annual Contest and Festival of the Northeastern Area of the National Yodlers Club of Switzerland. Mr. Heinzelman is a lifetime honorary member as an outstanding citizen of his native village and, as such, was personally invited by the group to attend the Festival. During the occasion the members of the group of Leistal were awarded first honors in the contest which included not only yodeling but flag throwing and Alpine horn blowing.

(*Continued on page* 37)

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

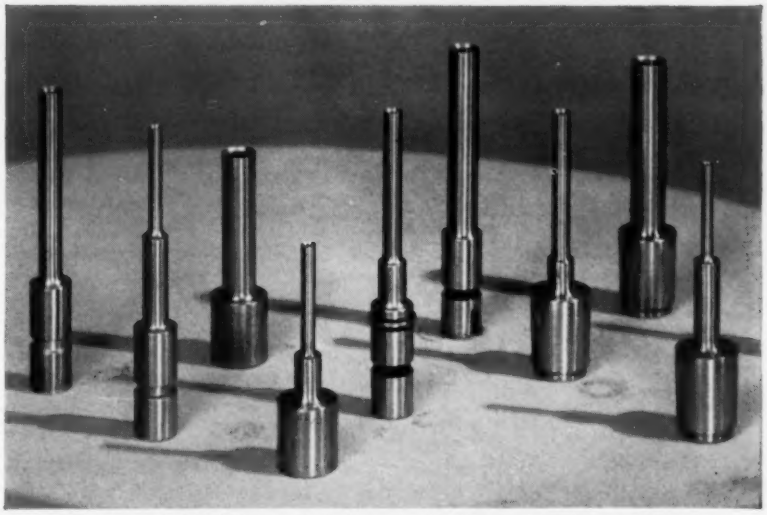
PENCIL SLIPPED . . . DIES BROKE

One of our customers reported his cold-heading dies were cracking and spalling. The spalled areas appeared to be the result of the hard case upsetting into the softer core.

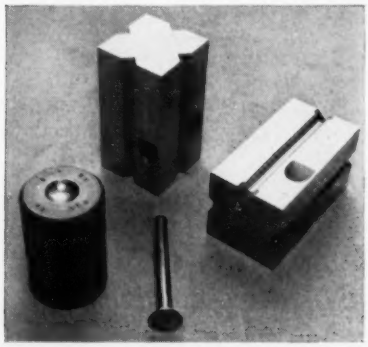
Our metallurgical contact man who visited the customer's plant couldn't find anything out of order, until he happened to read over an order the customer had entered for the steel. Then the light began to dawn.

The answer? The customer had failed to specify "cold-heading die quality" on the order. There's quite a difference between ordering "carbon tool steel" and "cold-heading die quality steel."

It's the difference between a tool steel that's processed for doing a fine job on severe cold-heading and steel that just isn't suitable for this type of special application.



"Even the roughest kind of service in binderies and printshops won't break paper drills when they're made of Omega tool steel," says William Gynther of Bent and Gynther, Portland, Ore.



The gripper and header dies shown above, made of Bethlehem XX Cold-Heading Die Steel, have the right combination of hard surface and tough core for cold-heading thousands of steel bolts each day.

OMEGA HELPS TO STOP BREAKAGE OF PAPER DRILLS

Drilling holes through paper may sound easy, but it isn't. Printers who do much paper-drilling will tell you that the drills often break and bend.

The other day we were given quite a fill-in on the subject by William Gynther, one of the owners of Bent and Gynther, Portland, Ore., suppliers of drills to the printing trade. Mr. Gynther told how he once noticed four broken drills on the desk of a prospective buyer. He made a wager that *his* drills wouldn't break, even though this printshop apparently gave the drills pretty severe treatment. The printer took him up—and hasn't broken a drill in some years.

The success of the "B and G" drills is attributed by Mr. Gynther to the unique taper inside the drill and to the grade of tool steel (Bethlehem's Omega). Omega is our silico-manganese grade of shock-resisting steel, and while it is intended mainly for cold-battering tools where terrific shock must be absorbed, it appears to have the ideal hardening properties for these paper drills, together with plenty of the toughness required to withstand stress and strain.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Always temper immediately after hardening

It's always risky to delay or to omit tempering immediately after a hardened tool cools following the quench. With a liquid-quenched steel always get the tool into the tempering furnace as soon as it cools down to about 150 to 200 F; an air-hardening steel should cool to 150 F.

Some heat-treaters spit on a tool—if there's no sizzle, it's cool enough to temper. You can also use a contact pyrometer or other indicators to get a more accurate check on the temperature of freshly quenched tools.

If you delay the temper—to check hardness or for some other reason—you're running the risk of permitting stresses to build up. And these stresses may crack the tool in half, even before it reaches the tempering furnace. Of course, such failures don't always occur if this precaution is ignored.

Some people just can't be convinced that it's risky to delay tempering after the tool cools following the quench. But there's no way to predict just when it may happen, so why take the risk?

Boring holes through a stack of paper doesn't sound like a tough job, but there's a lot of stress on these hollow drills which causes frequent breakage—unless they're made of the right steel.

WHAT'S YOUR PROBLEM?

ED. NOTE: Frequently "*Metal Treating*" is asked for answers to heat treating problems of various types. These are referred to technicians, metallurgists, etc. The correspondence below is typical.

Send us your problem—we'll try to get the answer and publish it for your benefit and others.

Gentlemen:

We are desirous of obtaining information with reference to materials suitable for use in cams.

We have used Iron and Steel castings as well as Bronze and Alloys but are always striving to improve our products and consequently we are looking for better materials which would be suitable for cam applications.

What information can you give us regarding the possibility of hardening the surface of such materials as Grey Iron castings, Meehanite castings, and can you tell us what steps would have to be taken to prevent distortion during the hardening process.

No doubt some materials would not require hardening or heat treatment after machining and we would like your views regarding this also.

If you cannot supply us with such information could you tell us whom we might contact.

We assure you that any information you may be able to pass along will certainly be appreciated.

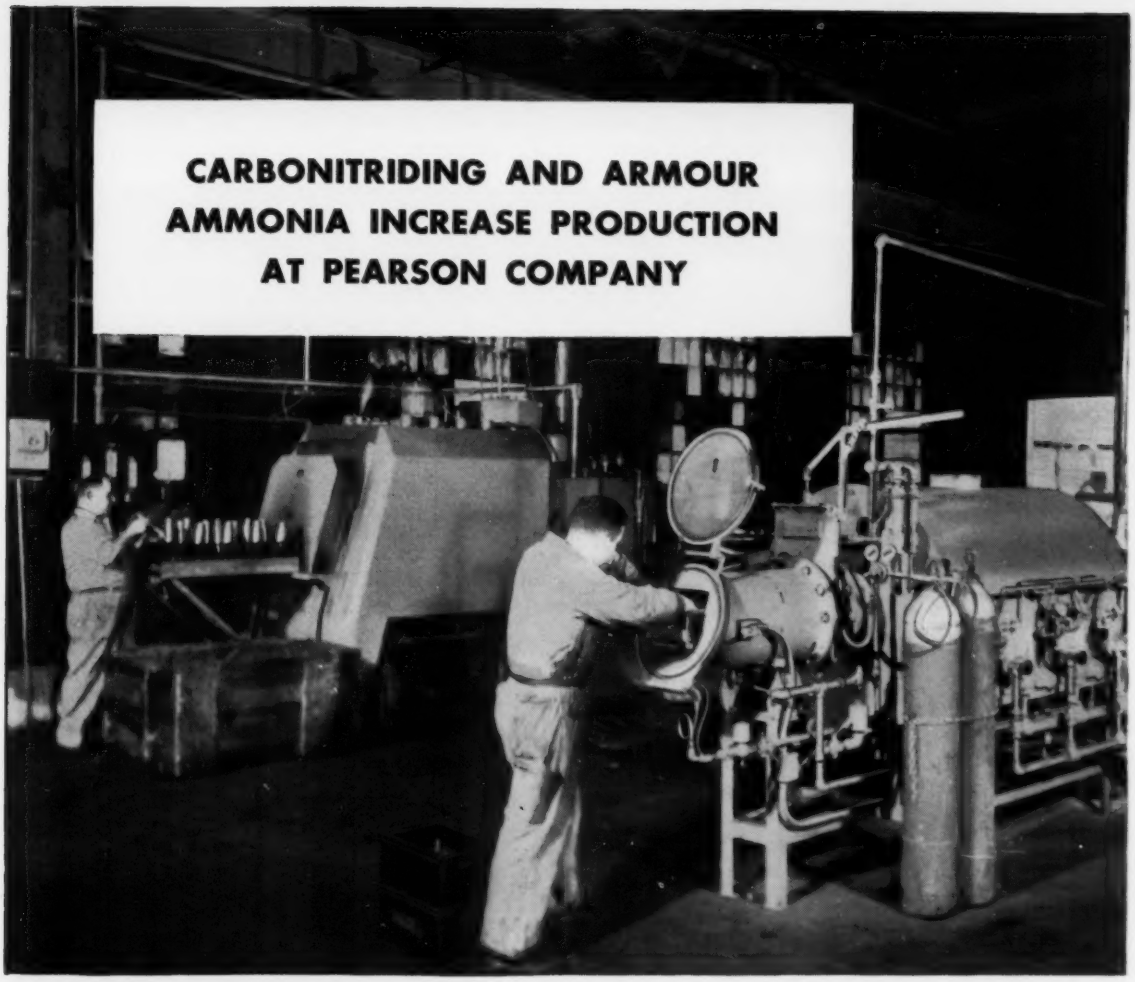
Yours very truly,
N. P. ROCK
H. G. Weber & Co., Inc.
Kiel, Wisconsin

Dear Mr. Rock:

We would like to inform you that we have passed your request for information on cam materials to the Meehanite Metal Corporation. We understand that they will forward literature to you which should prove helpful.

The hardening of high strength cast irons such as Meehanite metal does not vary greatly from the basic principles of hardening tool steel. Heat treatable grades are hardened by heating to approxi-

(*Continued on page* 32)



CARBONITRIDING AND ARMOUR AMMONIA INCREASE PRODUCTION AT PEARSON COMPANY

New processes prove more efficient, safer for metal treating

Those carbonitriding and brazing furnaces above mean greater production and safety at the Pearson Industrial Steel Treating Company in Chicago. And Pearson specifies Armour's pure, dry ammonia and dependable service for their carbonitriding.

All through the metal treating field, plants are using every improved process they can to provide their clients with better work. Since many of these new processes require ammonia, more and more companies like Pearson are calling on Armour ammonia and service for best results.

Carbonitriding has reduced costs and increased safety in many plants. And Armour men were there in many cases to give advice and help on installations. Those men in Armour's Technical Service Department are equipped and ready to help you in your installation.

Since 1947 Armour has sponsored a fellowship at the Massachusetts Institute of Technology for the study of carbonitriding and other modern metal treating processes. That knowledge is basic research, and available to you.

The booklets offered at right will show you how to put this knowledge to work in your plant. Write today for free copies. If your ammonia problem is unusual or pressing, write us today giving full details of your requirements.

Clip and mail this today!

Please send me the following free booklets:

☐ "Applications of Dissociated Ammonia"
☐ "Ammonia Installations for Metal Treating"
☐ "The Nitriding Process" ☐ "Carbonitriding"

Name_____ Title_____

Firm_____

Address_____

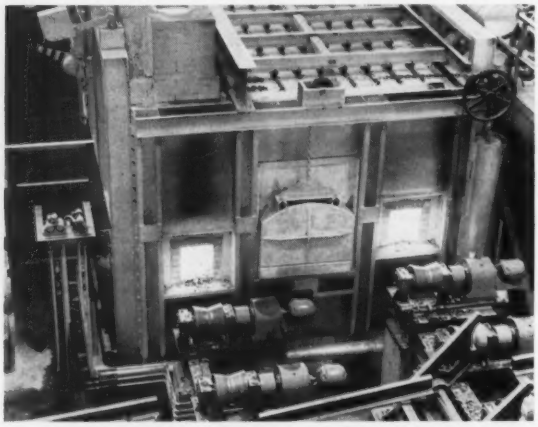
City_____ Zone_____ State_____

You can depend on Armour's ammonia and service

ARMOUR *Ammonia Division*

Armour and Company • 1355 West 31st Street • Chicago 9, Ill.

tubes from the plug mill for automatic charging through a small opening in the end of the furnace. Four synchronized pushers automatically move the tubes from the flanged rolls, across the super-duty refractory rail hearth to the discharging flanged roll system on the opposite side of the furnace, where the tubes are automatically transported through the small discharge opening located on the same end of, but opposite side of, the furnace.



The totally enclosed feature with only two small openings located on the same furnace end eliminates stack action, provides uniform heating, and automatic in-and-out operation on cycle as set by the mill operator, with a maximum production of 75 tons per hour to 2250 degrees F.

Unique Crane Attachment for Handling Steel Bar Stock

A unique "telescopic" crane, designed as an attachment for a fork-lift truck, is used by the Northwest Automatic Products Corporation of Minneapolis as a time and labor saving method of unloading truckloads of bar stock.

Bar stock is shipped to the firm's plant tied in bundles from ten to sixteen feet long and weighing 2000 to 10,000 pounds. The heavy, bulky bundles had long been an awkward materials handling problem, with manual unloading becoming more and more costly. The problem now seems to be solved, however, through the use of a crane device designed and built under the direction of Northwest's engineering department.

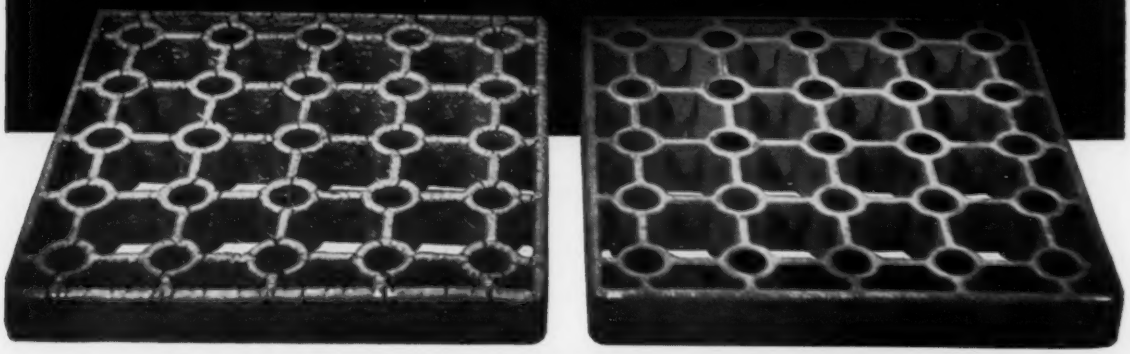
Basically, the device is a telescopic boom with a hook at the end. The boom can be extended, like a telescope, to a length of ten feet by turning a hand crank at the side. Bolted to the mast of a fork-lift truck from which the forks have been removed, the boom can be raised and lowered at will. Another hook at the base of the boom is used to carry loads too heavy for the end hook. A gas powered Clark Utilitruc of 10,000 pounds capacity is the fork-truck used.

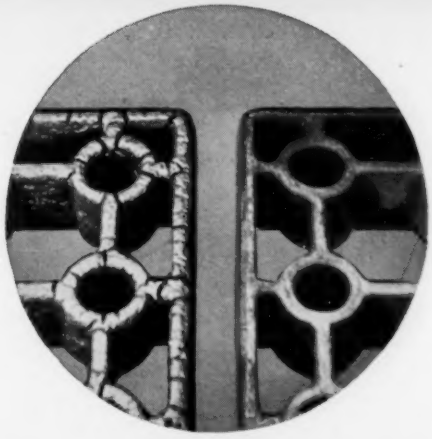
Brinell Microscope-Reader

The Pacific Transducer Corporation, 11921 West Pico Blvd., Los Angeles, Calif., announces a new low-cost Brinell microscope-reader for the measurement of the diameters of indentations made by Brinell type hardness testing machines. This new microscope features a reticle in a flat-field optical system and a self-enclosed concentrated beam of light. It provides a clear image of the indentation made by any Brinell type hardness tester with the sharp image of the reticle superimposed. The scale is calibrated in millimeters and tenths of millimeters. The total length of the scale is 7.0 mm.

Concentrated illumination of the indentation field is from a beam of light provided by a prefocussed battery-type illuminator. Both the bulb and the battery are universally available when needed for replacement. The microscope has a magnification of 20 diameters and the indentation can be seen easily and clearly. The device can also be used wherever a microscope is needed to make all other flat measurements within the range of 7.0 mm.

ONCE THEY WERE TWINS





...but identical service caused one to fail in 10 months... while the other still serves *after 33 months!*

The heat treat trays shown above were part of an order supplied to a large automotive manufacturer by Electro-Alloys. *On the left* is a tray of standard analysis (35% Ni.—15% Cr.) which had been specified and used by the customer for some time. *On the right* is a tray of special analysis—THERMALLOY* "58B"—recommended by our metallurgists after careful study of the job requirements.

At our suggestion, a split order was placed on a trial basis. The pictures, taken after 10 months in carburizing service followed by an oil quench, tell their own story. Standard trays (left) had failed completely. They were badly checked and showed "growth" of as much as 3/8 of an inch on one dimension. Trays of THERMALLOY "58B" (right)—with exactly the same amount and kind of service—barely showed signs of use. There was no checking or cracking and "growth" was scarcely measurable. In fact, we just checked this manufacturer again... and the same THERMALLOY "58B" tray is still in service *after 33 months.*

Here's proof that expert metallurgical knowledge *can* make a substantial difference in the life of heat treat parts. To put such knowledge to work for you, just phone your nearest Electro-Alloys office, or write Electro-Alloys Division, 5003 Taylor Street, Elyria, Ohio.

*Reg. U. S. Pat. Off.

AMERICAN Brake Shoe COMPANY

ELECTRO-ALLOYS DIVISION
ELYRIA, OHIO

How The Commercial Heat Treater

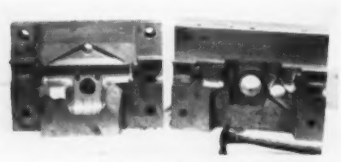
HELPS HIS CUSTOMERS . . . .

Reports of interesting experiences where MTI members helped solve problems for industry.

Extra-Bright Hardening

Special skills, equipment and methods are only a few of the advantages which the skilled commercial heat treaters, whose membership comprises Metal Treating Institute, offer to industry. From time to time, these columns will report unusual and outstanding instances of services rendered to their customers by Institute members.

Ferrotherm Company of Cleveland, specialize in bright heat-treatment of various parts, specifically the air hardening and hardenable stainless steel types of material. These parts go out so clean and bright that there is no trace whatever of the discoloration which normally accompanies heat treatment. (In most cases such discoloration is harmless and easily removed, if necessary, by the simplest cleaning methods. But many customers, for reasons of appearance, ask for the completely bright surface which Ferrotherm supplies.)



Hot Work Steel Bright Hardened

To show how critical some customers get and how much sales appeal a perfectly clean finish may have, one Ferrotherm customer recently complained that some of the parts were coming back showing finger marks! This applied to hardened dies and punches.

Ferrotherm immediately recognized the problem and corrected it by having their shop people put on cotton gloves in handling and in packing these parts.

This is, indeed, a long way from the "good old days" when heat treated parts, done without benefit of atmosphere or even salt baths, came out with a heavy incrustation of scale, which it was necessary to remove by severe sand blasting, pickling or other cleansing operations.

Of course, the complete elimination of any surface attack by this bright treatment, not only improves appearance, but contributes greatly to the retention of high dimensional accuracy and also to corrosion resistance.

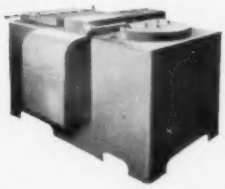
As illustrative of integrity and care in the processing and inspection of their own work, Ferrotherm reports that material from one customer is often shipped direct to the consumer without an intermediate inspection by the customer.

This includes not only stainless steel screw parts, but also hot work forging dies having a highly polished surface, which come from a concern in New York State, are processed at Cleveland and then shipped direct to the user in Michigan.

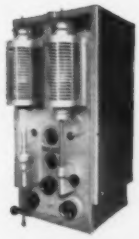
The first-class commercial heat treater exercises the most rigid inspection over all work before releasing it from his plant. He wants to be sure, himself, that the work is *right*.

(*Continued on page* 31)

..melting furnaces

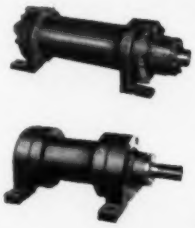


..laboratory equipment



..blowers

Heat Treating Furnaces...Yes!
and *LINDBERG* also builds..



..hydraulic cylinders
..air cylinders

..transformers

..high frequency induction units

In addition to heat treating furnaces, Lindberg designs and builds a broad and varied line of related products... from air cylinders to high frequency induction units.

The story of the complete line of Lindberg products is told in a newly published bulletin. Ask your local Lindberg Man for a copy (#250), or write Lindberg Engineering Company, 2450 West Hubbard St., Chicago, Illinois

LINDBERG FURNACES

Still in good shape

after 2 years of Nicrobrazing

at

2,150°F.

This Inconel bell retort has just been removed from a Model 24C bell type furnace at the American Gas Furnace Company, Elizabeth, N. J. It had been soaking at a temperature of 2,150°F. Heat-treating jobs at these high temperatures are daily routine at the American Gas Furnace Co.

Parts being loaded on Inconel racks for heat-treating.

At the American Gas Furnace Company, skilled workmen take on heat-treating jobs few other shops would care to handle . . . .

Nicrobrazing of stainless steel in which they use a nickel-chromium alloy as filler material, for example, at temperatures up to 2150°F. And copper brazing at 2100°F.

Or long annealing which involves heating the parts for four hours — up to a temperature of 2100°F.

All of these are done in a hydrogen atmosphere with a dew point of -60°F. or below. Furthermore, if the least crack occurs in a bell or retort under these conditions, proper heat-treatment does not take place—or the work is spoiled.

What retort material could take this treatment 10 to 16 hours a day yet give unusually long service life?

American Gas Furnace Company found the answer in strong, heat resistant Inconel®.

The newest of their six Inconel bell retorts is over two years old and there hasn't been a single failure. All the bells are still in excellent condition.

American uses tough, oxidation- and corrosion-resisting Inconel for other equipment, too. (Thermocouple protecting tubes, for example.) And in the furnaces they manufacture.

You'll find that Inconel can be readily shaped and welded to fit any practical design for fabricated equipment. It is produced in all the common mill forms, including a "T" section. If you need advice on high temperature problems, Inco's High Temperature Engineering Service will be glad to help. Write them. And ask for a copy of "Keep Operating Cost Down . . . When Temperatures Go Up."

THE INTERNATIONAL NICKEL CO., INC.
67 Wall Street New York 5, N. Y.

Inco Nickel Alloys

INCO

Monel® • "R"® Monel • "K"® Monel • "KR"® Monel • "S"® Monel
Inconel® • Inconel "X"® • Inconel "W"® • Incoloy®
Nimonic® Alloys • Nickel • Low Carbon Nickel • Duranickel®

How the Commercial Heat Treater Helps His Customers (cont'd)

Improving Tool Life

Perfection Tool & Metal Heat Treating Co., Chicago, Ill., uses three special treatments for critical hardening jobs. These are *Silver Finish Hardening* for clean bright hardening; *Nusite Hardening* for increasing toughness of high speed steel more than 100%; and *Ad-Life,* a combination of treatments to improve hardened and finished tools without re-hardening or distortion.

Perfection has reported some interesting experiences resulting from using these processes on customer's work—a few of them are given here:

A gear house made fifty big pinions of alloy steel which were finish ground by mistake before hardening. Instead of scrapping them they were successfully hardened by the Silver Finish method.

A food machinery manufacturer found that Ad-Life treatment on milling cutters purchased outside increased their life between grinds six times when cutting 410 stainless hardened to Rockwell C 40-42.

A steel company using high speed wire drawing dies and side blocks reported that Nusite Hardening increased die life by about 50%.

Thread chasers for a Chicago machine works ran twice as long after sub-zero treatment.

A can manufacturer was using carbon drill rod punches with an average service life of only sixteen hours. A slight change in original hardening resulted in doubling average life to thirty-two hours.

A tool manufacturer saved two hours polishing time on each die after Silver Finish Hardening them. ■ ■ ■

What's Your Problem (cont'd)

mately 1575°F and then quenching in a suitable medium. To prevent distortion or cracking of intricate parts, marquenching is sometimes advisable. This would require quenching in a bath at around 400°F. and then air cooling. However, it will be found that Meehanite metal is not as susceptible to quench cracking or greater distortion than the oil hardening tool steels.

We hope this information will be of help to you. We would like to suggest that you contact one of the Metal Treating Institute members near you when heat treating operations are considered. We are certain that they will be able to work with you on this matter.

Sincerely,
C. E. HERINGTON
METAL TREATING

Heat Treating ***ABSTRACTS***

REDUCING QUENCH CRACKS

Quench cracking is caused by variation in volumetric changes which occur when a piece of steel is quenched through the martensite transformation temperature. Interrupted quenching and hot oil quenching are two methods frequently used to overcome this difficulty, but in these procedures, particularly in the case of interrupted quenching, there is often too little control exercised over the many factors involved. The authors describe equipment which is designed to signal the moment at which martensite transformation begins to appear in a part being quenched, thus permitting accurate control of quenching.

The equipment described was designed and constructed for pilot plant use in a quench tank 5 ft. in diameter and 12½ ft. deep.

(*Continued on page* 36)

more for your money - - -

HOLDEN SALT BATHS — HOLDEN POT FURNACES

LESS DOWN TIME -- MORE PRODUCTION

Holden Type 701 Electrode Furnaces

. . . provide these Important Advantages

A—Replaceable electrodes without any down time to repair or rebrick the wall.

B—No salt leakage. A completely welded steel shell to support the high temperature refractory.

C—Life 24 months to 10 years, depending on temperature.

D—100% net working area with electrodes completely out of the work area.

● SAVE ONE THIRD On Your Present Furnace

Any competitive furnace using the older type construction can be converted to this design with an electrical saving of approximately 33-1/3%.

INVESTIGATE THE HOLDEN LEASE PLAN

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J. B. Carey—Detroit, TExas 4-8127
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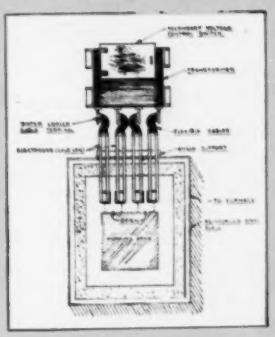
Holden Type 701-2 Submerged Electrode Unit with removable Electrodes.



Drawing of Holden Type 701-4 Submerged Electrode Furnace.

Holden Type 701-4 Submerged Electrode Unit with replaceable electrodes.

Three f.o.b. points: Detroit, Michigan—New Haven, Conn.—Los Angeles, Calif.

THE A. F. HOLDEN COMPANY

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Los Angeles 58, Calif.

11300 Schaefer Highway
Detroit 27, Mich.

HEAT TREATING HINTS

Interrupted Quench Still Useful

In these modern days of supersonic flight, radar, isothermal annealing, martempering, automatic heat treatment furnaces, etc., we are prone to forget that some of the old-time precepts are still useful. One of these is the interrupted quench.

An interrupted quench involves quenching a tool first in water, then removing it from the water before the hardening transformation has started and finishing the quench in oil. The tools should be removed from the oil while still warm and should be tempered immediately. On water hardening steels, an interrupted quench permits hardening of intricate sections which might crack if water quenched all the way. On oil hardening steels, the interrupted quench permits hardening of sections which are too large to harden properly if oil quenched all the way and at the same time avoids cracking which might occur if a straight water quench was used.

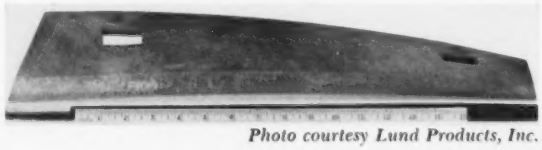


Photo courtesy Lund Products, Inc.

The attached photograph shows a tapered, curved knife which is made with a carbon tool steel inserted cutting edge. When knives of this design are brine quenched an appreciable percentage of them crack in the quench. Lund Products, Inc. of Maynard, Mass., has developed an interrupted quench procedure involving a brine quench followed by an oil quench which completely eliminates cracking of the knives in heat treatment.

J. Y. RIEDEL
Tool Steel Engineer
Bethlehem Steel Company
Bethlehem, Pa.

Correcting Case Depth Deviation

It shouldn't happen, of course, but it can and does even under the best of conditions. Over carburizing, that is, so that the specified case depth of .020"-.030" turns out to be .035" or more in the hardened work. Failing the obvious attempt to get a deviation from specification, what to do?

The writer was confronted with this situation

some time ago and became interested in the possibility of salvaging some rather valuable parts by completely removing the case, recarburizing to the proper depth and rehardening. It was reasoned that the case could be removed in two directions —towards the center of the section by diffusion, and towards the surface by decarburizing and diffusion. True, the carbon in the core would be slightly higher because of the diffused carbon from the case, but not damagingly so if the core section is fairly large compared with the case depth, and if the original carbon content of the case is not excessively high.

A few preliminary experiments indicated that the process is quite feasible, using a generator gas of high dew point to provide the decarburizing condition. The length of time required for the diffusion–decarburizing process is dependent on a number of factors, chiefly the depth of case to be removed, the carbon content of the case, and the type of atmosphere available. In general, it will require two to four times as long to remove the case as was required to produce it in the first place.

Obviously this process is comparatively expensive, and can usually be considered only for parts which have a considerable amount of machining prior to carburizing. Another limitation is the not too predictable size change that results from the carburizing-decarburizing-recarburizing cycle, although the decarburized part is in excellent condition for some remachining prior to final carburizing.

Recarburizing is done on the same schedule as for green stock (this time to the *correct* depth). If core hardness is at all critical hardening is best done by reheating after the parts have cooled from carburizing temperature. This permits close control of core hardness by careful selection of the final hardening temperature.

L. J. HAGA, President
State Heat Treat, Inc.
Grand Rapids, Michigan

Razor Blade Test For Decarb

Conventional tests for salt bath decarburization including macro, fracture, chemical analysis, and file tests are time consuming, and they usually require special equipment. This test, which requires only a discarded razor blade, has been checked and used successfully by a number of salt bath furnace users. The razor blade test requires only immersion of a blade in the molten bath for the prescribed time of 10 or more minutes at a given temperature, followed by a quick water quench. (Do not use a Stainless Steel Blade.) Because of the thinness of the blade, this test is extremely sensitive to an oxidizing bath. Partial or complete decarburization can be determined by the ductility of the quenched blade.

If the blade bends, then carbon has been depleted, and the salt bath showing this evidence of a decarburizing tendency should be rectified immediately. However, if the blade snaps, the bath is neutral.

This test is not only sensitive and foolproof, but it can be conducted by furnace operating personnel without involving laboratory trained technicians. By following the recommendation of the salt supplier, proper rectification of a bath can quickly be made.

Ajax Electric Company, Inc.
Philadelphia, Pa.

Facts and Figures on
HEAT TREATING COSTS

(Continued)

heat treating after installing new equipment is not clear, in view of the author's statement that nearly all work was done in the new equipment.

In one review that author states that the cost of the new equipment was $13,630.00. This agrees with the depreciation figure of $908.54 a year for 15 years. However, the cost of installation is not included in the table of costs, even though the author mentioned specifically $1,424.00 for running a gas line. The items for maintenance labor and materials for the new equipment, totalling $505.81, may be fair for the first year but will certainly increase rapidly during the expected 15 years of life.

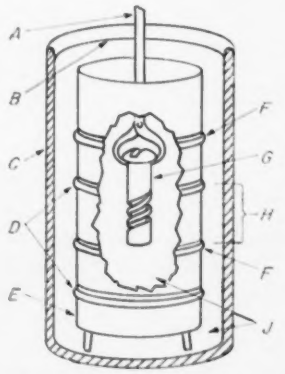
The author reports the cost of fuel and many other items to the penny, but leaves out the largest and most important costs of all, namely, *labor* and *supervision*. Surely, he does not operate a heat treating department, even one with only four furnaces, without a payroll! Even assuming that *one* good man working eight hours a day could turn out all the work, and assuming a pay rate of $1.75 per hour, this would amount to $70.00 a week or about $3,640.00 a year. Then there must be added the cost of inspection, supervision and plant overhead, which would probably add at least 100% and more probably 200% to the direct payroll. The commercial heat treater supplies all of this, included in his charges.

Upon the fragmentary information given by the author in his "analysis of heat treating costs," so many vital items are omitted that no real estimate of costs is possible. But even the figures given show that a large *loss* undoubtedly resulted from in-plant operation, as compared with the cost of first class commercial heat treating services. ■ ■ ■

The major component of this equipment is a plywood coil form 3½ ft. inside diameter which is placed inside the quench tank. Several coils are wound on the form and one is used as a "driver" and another as a "secondary" or pick-up coil. By selecting various coils, measurements can be made at different depths in the quench tank. When martensite transforms, an increase of magnetic permeability increases the magnetic flux linkage between coils and so changes the voltage induced in the pick-up coil. This voltage in turn causes signals to operate. Thus accurate records of the time required to quench a part can be made. The equipment is designed to signal when transformation occurs slightly beneath the surface of a part. It is at this point that parts can be removed from the quench and cooled in air to reduce internal stresses.

The theory of the equipment is based on the fact that austenite is not ferromagnetic whereas martensite is. The equipment in use is designed to take advantage of these characteristics. The sketch below shows the general arrangement of a quench tank with the coil form in place.

(Continued next page)



Sketch showing location of typical part during quenching. A—tongs, B—level of quench, C—quench tank, D—driver coils, E—plywood coil form, F—pickup coils, G—part being quenched, H—middle zone used for this part, J—water in quench tank.

The equipment is believed to hold possibilities for shop installations but units would have to be made up according to individual specifications. It allows for not only reducing quench cracking but quality control of such factors as variations in steel composition, fluctuation in temperature of the work piece, agitation efficiency and bath composition.

(Abstracted from, *"A Signaller To Reduce Quench Cracking of Steel,"* By L. D. Jaffe, D. C. Buffum and I. L. Preble, *Metal Progress, October, 1953.*)

Institute News (cont'd)

NEW MEMBERS

Five companies, having met all qualifications for membership, were welcomed into the Institute during January. The addition of these new members brings the total membership to 81 firms. New members and their representatives are:

Temperature Processing Inc.
228 River Road
North Arlington, N. J.
Representative:
Mr. Wm. E. Engelhard, Pres.

Hushek Metal Processing Co.
1536-40 W. Pierce Street
Milwaukee 4, Wisconsin
Representative:
Mr. Joseph F. Hushek, Pres.

Spindler Metal Processing Co.
2338 Mead Street
Racine, Wisconsin
Representative:
Mr. Roy M. Spindler, Pres.

Wesley Heat Treating Co.
1333 W. Pierce Street
Milwaukee 4, Wisconsin
Representative:
Mr. Harold R. Wesley, Pres.

Wesley Metal Treating Co.
2320 Mead Street
Racine, Wisconsin
Representative:
Mr. Melvin F. Kesting, Pres.

LETTERS TO THE EDITOR

Gentlemen:

Recently I came across an edition of "Metal Treating." I am presently employed as an operator in the heat treat department of the Canadian Pratt & Whitney Aircraft Company and am, therefore, interested in subscribing to this book, if it is at all possible.

Would you please forward all particulars as to how I might obtain same, because I believe that this book will help me greatly in the type of work which I am doing.

Thanking you in advance for your kind cooperation in this matter, I remain,

CHARLES FULFORD
Crawford Park
Verdun, P.Q., Canada

Dear Editor:

The other day I came across your "Metal Treating" publication. Would you please send me the subscription rates for a year? I am a metallurgical engineer assigned to the heat treating department as a "Looper" in the Bethlehem Steel Company.

Thank you,

THOMAS LEIBINGER
Bethlehem, Penna.

Dear Sir:

From time to time your very interesting and helpful magazine has come into my hands. I have found it enlightening in my work as a tool hardener with Draper Corp., Hopedale, and, therefore, would like to receive all the issues as they appear. I would like to be placed on your mailing list if possible.

GERHARDUS HAAGSMA
Whitensville, Mass.

Gentlemen:

Many thanks for your letter of Nov. 6th, advising that you will furnish us with 16 copies of each issue which will contain articles on furnace manufacture and operation.

You further stated that your magazine is circulated on a control basis to those actively in the heat-treat industry, and I feel that our company is definitely in this category, since at least 50% of our product goes directly to heat treaters and manufacturers of heat treating equipment. This, of course, is our reason for advertising in your magazine, since we feel that you cover the heat treat field very well.

Consequently, I would greatly appreciate your adding the following names of our company members to your mailing list, so that they may receive copies of "Metal Treating" in the future.

P. L. McCULLOCH, JR.
Sales Manager
American Brake Shoe Co.
Electro-Alloys Division
Elyria, Ohio

Gentlemen:

I have been receiving your magazine regularly and find it very interesting. I have been passing it on to the head of our Order Department who is dealing every day with heat treating problems of our customers. However, I find that I like to retain copies myself for some time to study the various interesting articles which appear. I would, therefore, appreciate it if you could send an additional copy of each issue to the following address.

E. W. DUTCHER, Vice-president
Uddeholm Co. of America, Inc.
New York, New York

Gentlemen:

We have seen your publication and feel that it would be of great aid to us. Will you please, therefore, advise us of the subscription price and include a subscription form.

FRANK RIOLO, Sec'y. and Works Mgr.
Parnat Precision Machine Works, Inc.
Bronx, New York

MANUFACTURERS' LITERATURE

The literature listed below contains information of interest to heat treating organizations. For your Copy write direct to the manufacturer and be sure you mention seeing it reviewed in "METAL TREATING".

ENGINEERING DATA ON HR-3 CAST ALLOY

Engineering data bulletin No. 1 has just been released on HR-3 (37% NI-17% CR) cast alloy for reference use by designers and engineers for parts subject to corrosive elements and high temperatures. Copies are available upon request from Standard Alloy Co., Inc., 1679 Collamer Road, Cleveland 10, Ohio.

The bulletin gives data on chemical composition, physical properties, mechanical properties, heat and corrosion resistant properties, recommended design stresses, heat treatment, machinability and weldability.

NEW THERMOCOUPLE PROTECTION TUBE

Publication of a new bulletin, No. P1261, describing a metal-ceramic thermocouple well, just put on the market, has been announced by The Bristol Company, Waterbury 20, Conn. The bulletin outlines all properties and specifications of the new protection tube, which is said to combine the thermal conductivity and shock resistance of metal with the corrosion and deformation resistance of ceramics. The wall of the tube has the same thermal conductivity as cast iron, and although it is only 1/8 inch thick, only single wall construction is needed.

FURNACE AND OVEN CONTROL

A new catalog of complete control systems for furnaces, ovens, dryers and kilns has just been announced by The Bristol Company, Waterbury, Conn. The new book, No. P1260, contains detailed engineering specifications and prices necessary to choose the proper control "package" for a particular installation. Several models of the electronic dynamaster potentiometer and millivoltmeter type pyrometer controllers, recorders and indicators, as well as bulb-and-tubing recording or controlling thermometers are described and pictured. Electric control relays, motor operators and controllers are included, in addition to electric and air-operated control valves.

Essential accessories, such as charts, scales, thermocouples, bulbs and tubing, switches, panels and combustion safeguards are included.

WET BLASTING MACHINE

Bulletin No. 93, describing its new Model 30 Liquamatte wet blasting machine, has been published by American Wheelabrator & Equipment Corp., 1175 South Byrkit St., Mishawaka, Ind. Complete general specifications and illustrations are presented. The unit is designed for all sorts of precision cleaning and finishing operations involving small parts which can be lifted and handled manually, and which are capable of going through a door opening 22½" x 19".

Some typical applications for the machine are heat treat scale removal; fine deburring; blending grinding lines; finishing and redressing in the manufacture and maintenance of small stamping dies; etc.

THERMOCOUPLES AND ACCESSORIES

A new edition of its 36-page bulletin, "Thermocouples and Accessories", has just been issued by The Foxboro Company of Foxboro, Mass.

Listed, with specifications, are standard thermocouples for all applicable temperature ranges. Separate sections are devoted to the tubular-type iron-constantan couples, wire-type iron-constantan and copper-constantan couples, and Chromel-Alumel alloy and platinum couples.

Generously illustrated, the bulletin contains dimensional drawings of complete assemblies. Ten installation diagrams are helpful in determining types of thermocouples needed for various furnaces.

In addition to complete parts lists for each type, there are catalogued sections devoted to couple supplies and accessories, such as connection heads, protection tubes, etc.

AIR AND HYDRAULIC CYLINDERS

A new Bulletin, No. 800, has been prepared by the Air and Hydraulic Division of Lindberg Engineering Company, 225 N. Laflin St., Chicago 7, Illinois. Their standard catalog line of heavy duty air and hydraulic cylinders are described in detail along with the features of each. Descriptions of large, special custom built heavy duty air and hydraulic cylinders are also included.

HIGH PRODUCTION BATCH FURNACE

A new bulletin, No. SC-163, on the Allcase batch type controlled atmosphere furnace has just been released by Surface Combustion Corporation, Toledo, Ohio.

It is a six-page illustrated folder that describes the features of the standard and heavy duty sizes of their radiant tube heated furnace. Equipped with a recirculating fan and an enclosed quench it can be used for all types of controlled atmosphere steel treatments. Included in this bulletin are detailed construction drawings and photographs of typical process applications.

PROTECTIVE ATMOSPHERE TROUBLES

A new bulletin on how to cure protective atmosphere troubles has been announced as available from the General Electric Company, Schenectady 5, N. Y.

Designated as GER-811, the 20-page publication is a reprint of a special report and comprises a chapter from the book, "Protective Atmospheres," (John Wiley & Sons, Inc.) by A. G. Hotchkiss and H. M. Webber of the G-E Industrial Heating Department. The bulletin includes a check sheet for troubles and cures in the operation of protective atmosphere furnaces.

TEMPERATURE CONTROL SYSTEMS

A new bulletin, F 6149 on "Temperature Control Systems," is available from the Wheelco Instruments Division. Barber-Colman Co., Rockford, Illinois.

Included is a section said to help in the selection of sensing elements and their correct use for the most satisfactory results. Instrument industry control terminology is given in this bulletin, as well as rules to follow in selecting the proper method of temperature control for process characteristics or reaction.

A complete explanation is contained of the various types of control systems, ranging from two-position "on-off" to proportional position with automatic reset. The questions of where to use each system and what instruments are required for the best control results are clearly answered in this bulletin.

BLAST CLEANING

"Blast Cleaning," is a new booklet available from the Pangborn Corporation, Hagerstown, Md. Its purpose is to supply non-technical information to anyone who would like to know more about the possibilities of blast cleaning in his field.

The economics of blast cleaning are discussed in terms of the type of surface to be cleaned, finish required in a specified time, and the price per piece cleaned with lowest possible maintenance cost. The book presents the advantages of various types of blast cleaning machines for specific uses. Abrasives are treated in terms of part to be cleaned, finish, and cost.

CARBONITRIDING AND AMMONIA CYLINDER INSTALLATIONS

Two informative booklets entitled, "Ammonia Cylinder Installations for Metal Treating" and "A Survey of Industrial Carbonitriding Practice" are available from Armour and Company, 1355 West 31st Street, Chicago 9, Illinois. The survey on carbonitriding practice covered fifteen plants in detail and describes the uses of carbonitriding, temperature and time cycles used, furnace atmospheres, quenching, tempering and finishing operations at these plants.

The booklet on cylinder installations provides general details for using single or manifolded cylinders and covers the properties of anhydrous ammonia, cylinder construction, method of withdrawing gas or liquid, general specifications for fittings and auxiliary equipment and safety precautions to be observed.

BLAST CLEANING

The Metablast process for surface finishing is described in a four-page bulletin issued by the American Metaseal Manufacturing Corporation, West New York, New Jersey.

Photographs show how a pre-determined, consistent finish can be applied to metal parts through the use of a special abrasive suspension applied to parts by means of air pressure. "Before and After" views of various parts are shown, and a detailed description of the operation of the Metablast machine is included.

INDEX TO ADVERTISERS

Keycase hooks made by
S & Z Hooks Company,
Brooklyn, N. Y.

AEROCARB® Carburizing Compounds give spring steel properties to low carbon steel

METRO HEAT TREAT COMPANY, with plants in New York City, Englewood, and Ridgefield, N. J., had a problem which AEROCARB Carburizing Compounds solved very nicely:

S & Z Hooks Company wanted to make keycase hooks economically from low carbon steel, since using spring steel would involve costly die wear and expensive high pressure forming. Could Metro treat the low carbon hooks and give them spring steel properties?

Metro said they could, and they did — after intensive study and experimentation.

They found that salt bath carburization would be required, but they were unable to get the desired properties — long bath life, proper spring tension — until they tried Aerocarb Carburizing Compounds

Today, Aerocarb W is doing the job. Metro's careful handling gives their customer hooks with precisely the properties they need. Aerocarb W leaves the hooks easy to clean for plating and assembly, and is giving Metro extended bath stability as well.

Why not get the full story on Aerocarb W? It may help you solve a tough metal treating problem.

Cyanamid's heat treating compounds include:
AEROCARB® Carburizing Compounds
AEROCASE® Case Hardening Compounds
AEROHEAT® Heat Treating Compounds
other products for metal processing include:
AEROBRITE* Metal Processing Aid
Calcium Cyanamid 6-16
Metallic Stearates
Surface Active Agents
Acid and other Heavy Chemicals
*Trade-mark

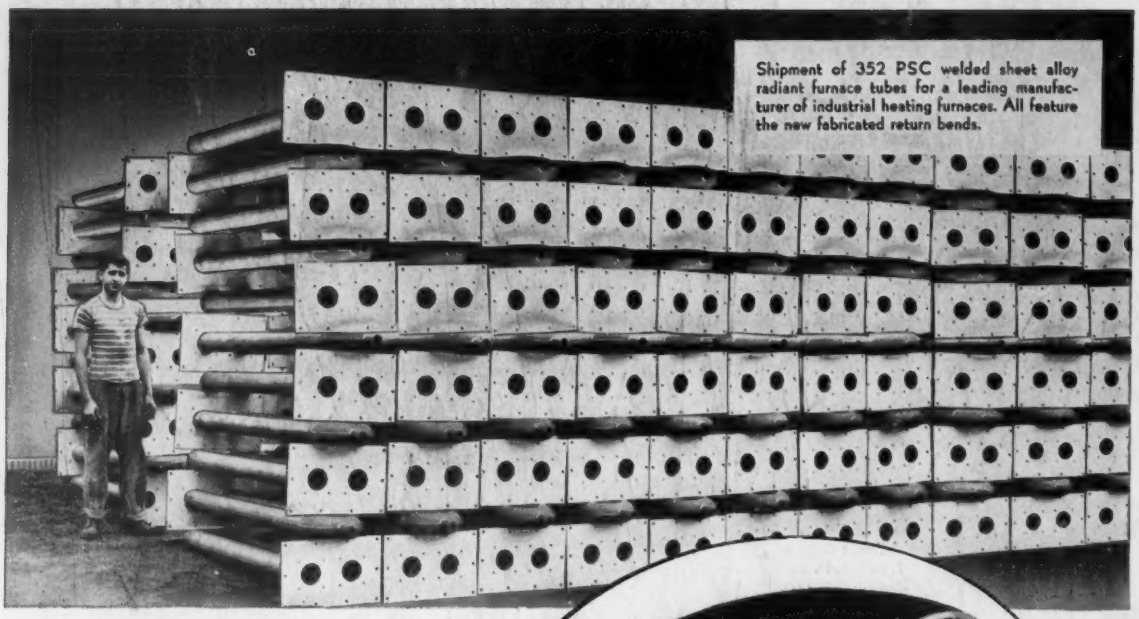
MT-1

AMERICAN Cyanamid COMPANY
INDUSTRIAL CHEMICALS DIVISION
30 Rockefeller Plaza, New York 20, N. Y.

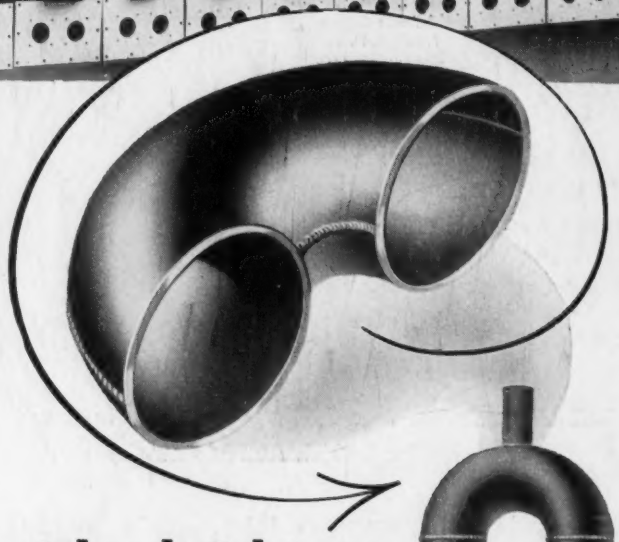
☐ Send data sheet on AEROCARB W
☐ Have technical representative call

Name_____ Position_____
Company_____
Address_____
City_____ State_____

In Canada: North American Cyanamid Limited, Toronto and Montreal

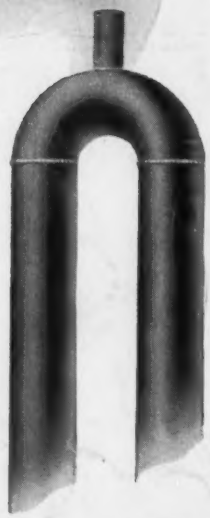


Shipment of 352 PSC welded sheet alloy radiant furnace tubes for a leading manufacturer of industrial heating furnaces. All feature the new fabricated return bends.



PSC's *New* FABRICATED Return Bends

make radiant furnace tubes last longer



Here are three reasons why sheet alloy radiant furnace tubes equipped with the new PSC fabricated return bends are serving better: (1) Uniform wall thickness, and smoothness of interior result in uniform flow of gases; less cracking and burning out at the bends. (2) Light-wall construction saves heat-up time and fuel. (3) From 33 to 50% lighter than cast tubes: lower initial cost; lower freight cost (important for export); easier handling.

PSC precision-assembled tubes are standard on many models of radiant furnaces. Also a complete line of heat-treating containers and fixtures, of weight-saving sheet alloys of any type. Send blue prints or write as to your needs.

Send for CATALOG 52

THE PRESSED STEEL COMPANY

of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

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